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Workmen Shot From Tunnel Through the Bed of a River

By Eustace L. Adams

BROOKLYN BRIDGE was jammed with mid-afternoon traffic. On the East River, far underneath the lofty structure, tugs and barges were busy with their endless tasks. Suddenly passengers on the bridge and crews of boats heard a muffled roar, and a geyser shot from the river twenty feet into the air. Dark forms mingled with the water, and a moment later, when the rush of the geyser had died down, three men were seen floating on the surface of the river.

One of these men quickly disappeared from sight. His dead body was later recovered. The other two swam for shore and were rescued. One of them died before he could be taken to the hospital. The other lived. All three men (sand hogs, who had been digging in an atmosphere of compressed air under the river) had been blown from their posts in front of the great steel shield which is boring through the East River bed to the open air. They were shot through twenty-seven feet of river mud, twenty-five feet of water and an additional twenty into the air on top of a geyser of mud and foam.

The first knowledge that the officials at the Brooklyn end of the new subway tube had of the accident was when a number of terrified workmen rushed into the compressed air caisson, clamoring to be let out. Among these was one man who had been a witness of the accident, and from him a coherent story was obtained.

The tunnel in which this strange accident occurred had been pushed out under the river for about three hundred feet, by what is known as the shield method. When engineers commence their underground tunneling, a heavy steel shield is built at the end of the shaft where the men are at work. This shield is pushed forward into the mud or dirt for a distance of two feet by a number of hydraulic rams which are capable of exerting a pressure of five thousand pounds to the square inch. In the shield are a number of doors which allow the workmen, or "sand hogs," to dig away the dirt, stones and mud in front so that the shield may be moved another two feet.

The question naturally arises: What keeps the mud and water from coming into the shield and overwhelming the workmen? A short distance behind the shield is a bulkhead wall, containing air locks. The entire space forward from the airlock is kept filled with compressed air. This air, when maintained at the proper pressure, balances that of the water and keeps it from flowing into the tunnel. If sufficient pressure is exerted by the air-pumps, the water is driven still farther away, and the workmen may work on dry ground, instead of on mud of a molasses-like consistency.

As they excavate in front of the shield, the workmen plank up the opening they have made and remove the planks just before the shield is to be pushed forward. The shoring serves merely to keep loose earth and stones from falling upon the men as they work.

Four men, who were outside the shield,

had just removed some of the shoring when earth began to drop rapidly away from one spot in the top of the tunnel. One of the men seized a bag of cement which is kept for such an emergency and attempted to block up the rapidly growing hole. Suddenly there was a report like a pistol shot. His startled comrades saw the man jerked up out of sight. Then they realized what happened. The man had been blown away like a pea in a pea-shooter. One of the men managed to save himself by clinging to the shield. The other two victims were shot upwards to the surface of the river.

The instant that the work of rescue had been completed, officials began the work of repair. It was found that the accident had been caused by a spot in the bed of the river which had been unable to withstand the air pressure of twenty-four pounds to the square inch that had been maintained in the tunnel. As a result the bottom of the river had blown out like a faulty automobile tire when overcharged with air.

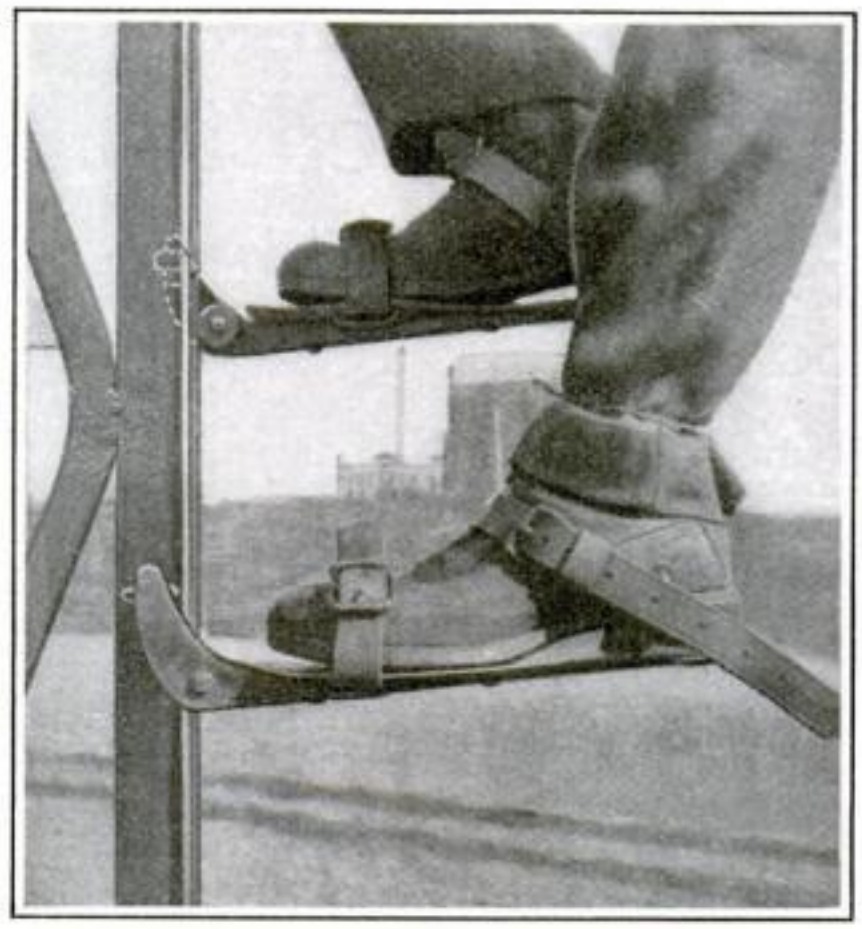
Only once before in the history of tunneling has a workman been shot through the bed of a river and survived. Eleven years ago a "sand hog" was blown through the bed of the East River during the construction of the present subway system. Although severely injured he survived the shock, and by a curious coincidence was working on the tunnel in which the recent accident occurred.

Militia Aero Corps

TWENTY-FOUR states are at present organizing aero corps to be included in their National Guards and Naval Militias.

Climbing Steel Poles with the Aid of Iron Shoes

IT was always an easy matter for a lineman to stick the points of his climbers into the sides of a wooden pole and reach the top with the agility of a squirrel. With the introduction of steel poles for high tension electrical lines, some other climbing help had to be found. A forged steel shoe has been invented, which is neatly strapped over the regular shoe.



Spikes help a lineman to climb a wooden pole, but not a pole of steel. A shoe has been invented which enables a lineman to clamp himself step by step on the steel pole

The toe of the steel pole-climber curves upward. On its tip there are two steel projecting bearings or clamping points, and these points tell the secret of the device. A square steel block, having four sharp corners is placed just beyond the toes of the steel shoe. When dull from use these corners may be substituted one for another.

This special block bears on the outside of the steel pole, and a steel point situated at the end of the climber bears on the opposite side.

The climbers have a clamping action between the block and the point on the edge of the steel pole. This action is accomplished by the pressure of the lineman's weight on the end of the climber. Naturally his weight will come at the right point in climbing the pole. As he raises his foot for the next step, the lifted heel releases the grip of the climber. The steel climbers weigh about as much as the old style grippers used for the wooden poles.

An Invisible Ink

WHEN the juice of an onion or lemon is substituted for ink, no visible effect is made on the paper until heated, when the writing will stand out very plainly.

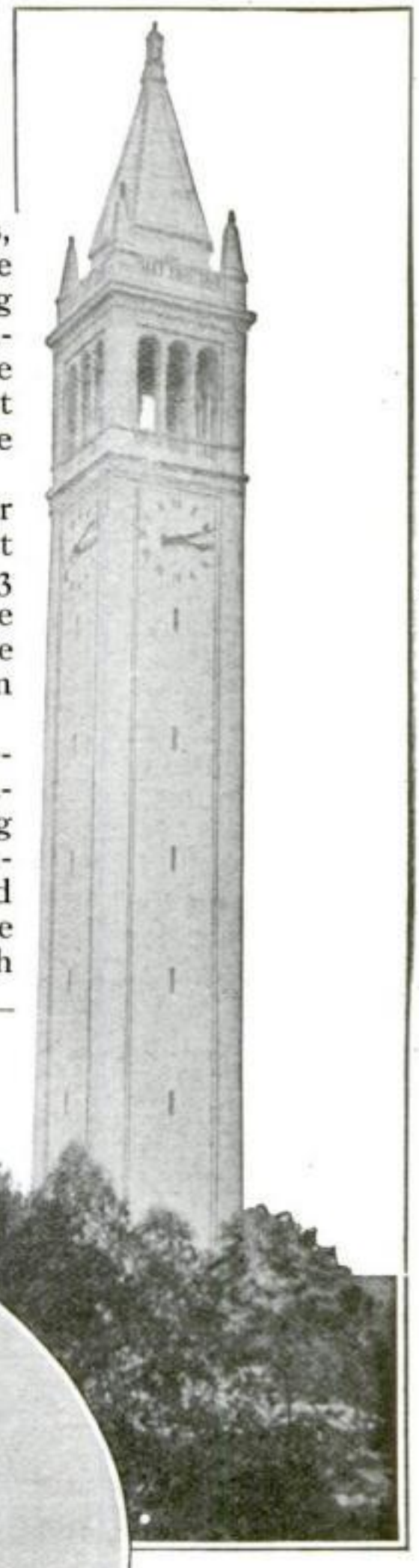
Rocking a Three-Hundred Foot Masonry Tower with Your Hand

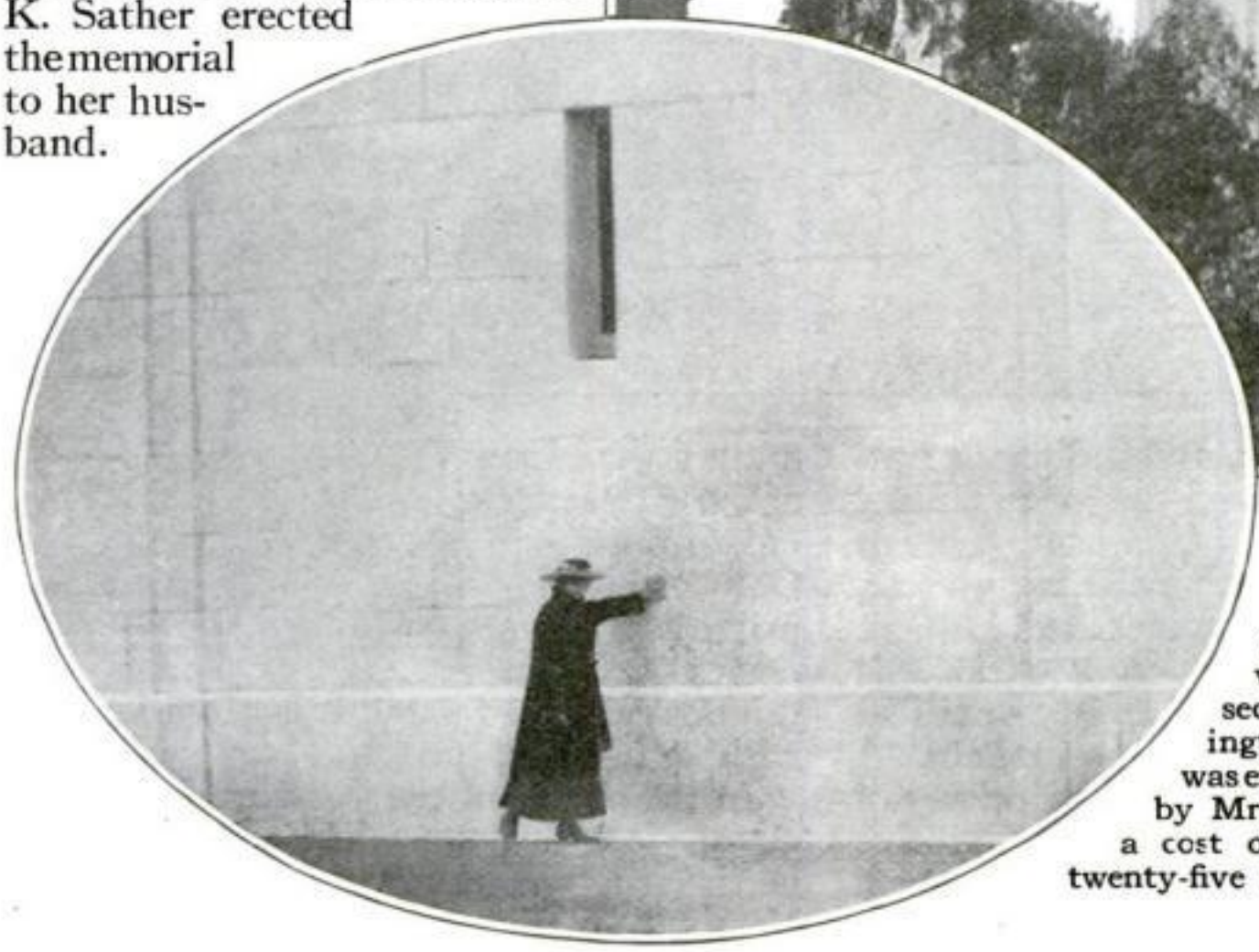
BY the mere pressure of your hand you can rock "Sather Campanile"—the three-hundred-and-two-foot memorial tower just completed on the campus of the University of California.

In order to minimize the danger from earthquake shocks, the architect, Professor John Galen Howard, and the engineer, Professor Charles Derlith, Jr., so built the strong steel frame of the Campanile that cross-bracing is eliminated at alternate stories. As a result the vibration of the tower is like that of a steel rod one end of which is thrust in the ground. In an earthquake the tower would vibrate like a tree.

According to Professor Elmer E. Hall's tests, the tower has a vibration period of 1.13 seconds. By pressing against the steel frame at the top of the Campanile every 1.13 seconds he was able to rock the tower, so that earthquake recorders (seismographs they are called) registered the vibrations. However, the amount of motion was less than the thickness of this sheet of paper.

The plan on which the tower was built is to prevent a reenforcement of the rocking caused by an earthquake vibration. For instance, a child can set a hammock swinging violently simply by pushing at the right moment, no matter how heavy the load may be. If the pushes are not timed correctly, the swinging is retarded. It is the same with the Campanile. The plan is to prevent cumulative swaying, such as would occur if the period of the earthquake and the vibration of the tower were the same, and such as would cause the structure to collapse. Mrs. Jane K. Sather erected the memorial to her husband.



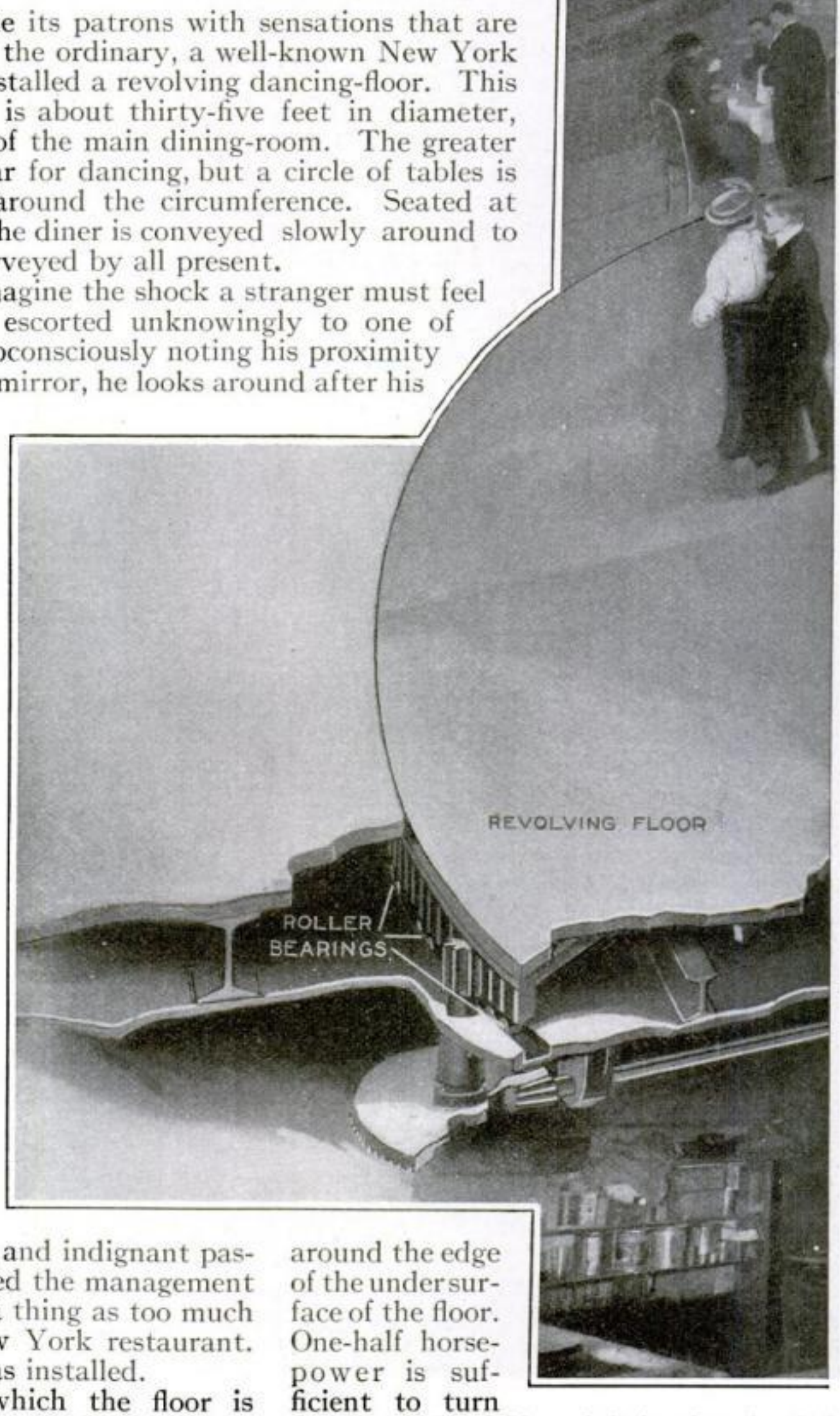


The pressure of your hand will swing the bell-tower at Berkeley, Calif., which in height is second only to Washington Monument. It was erected. as a memorial, by Mrs. Jane K. Sather at a cost of two hundred and twenty-five thousand dollars

Dancing on a Revolving Floor: New York's Latest Cabaret Fad

IN order to provide its patrons with sensations that are somewhat out of the ordinary, a well-known New York restaurant has installed a revolving dancing-floor. This circular floor, which is about thirty-five feet in diameter, occupies the center of the main dining-room. The greater part of it is left clear for dancing, but a circle of tables is generally arranged around the circumference. Seated at one of these tables, the diner is conveyed slowly around to survey and to be surveyed by all present.

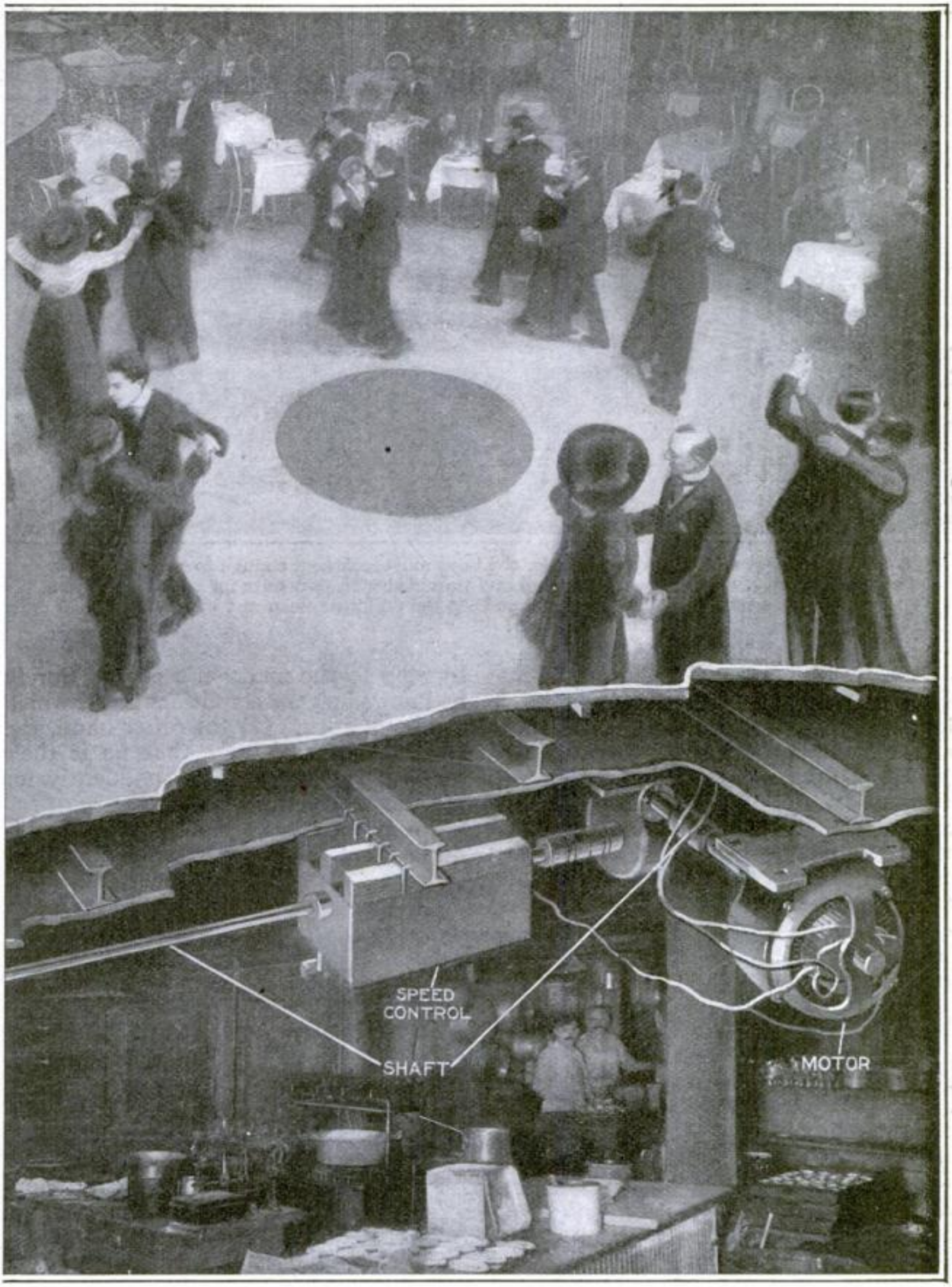
One can readily imagine the shock a stranger must feel when, having been escorted unknowingly to one of these tables and subconsciously noting his proximity to a certain pillar or mirror, he looks around after his study of the menu card and finds himself in a totally different position.



The ordinary speed of the floor is one revolution in eighty minutes. The motion is hardly perceptible as one steps on to the floor, but is sufficient to swing one all the way around during the course of a dinner. The original intention was to revolve the floor rapidly enough to give a kind of a merry-go-round effect, but a polished floor is slippery and centrifugal force is constantly on the watch for the unwary. Upset tables, broken mirrors, and indignant passengers soon convinced the management that there was such a thing as too much speed even in a New York restaurant. Hence a regulator was installed.

The manner in which the floor is driven is very simple. It is pivoted at the center and is supported on rollers. A small motor, mounted on the ceiling of the room below, provides the motive power. It drives a small pinion which meshes with a rack running entirely around the edge of the under surface of the floor. One-half horse-power is sufficient to turn the heavy floor, though it is often loaded with a hundred people.

In the center of the floor is a large circle of glass through which colored light is thrown. A fancy dancer can thus obtain beautiful effects.



A New York restaurant is responsible for this newest development of the dancing craze. At first they tried to turn the floor at high speed, but this was found too fast for New Yorkers. Now the floor turns at a solemn but relentless rate. The whole floor, with as many as one hundred persons, is turned by a one-half horsepower motor, so well arranged is the mechanism

The Making of a Telegraph Boy

Training Messengers to Become Managers

A tailoring department is maintained, for the boys must look neat enough to enter the finest hotels in the city. Each boy is measured and provided with two suits for which he pays a small weekly rental. Three tailors keep the uniforms clean and in repair

IT is a big undertaking to produce useful and capable men from boys whose opportunities for education have been limited and who are practically without training. Yet that is the task assumed by one of our great telegraph companies. Its messenger boys are to become not merely bearers of dispatches, but men of character.

Fred Geigle, manager of these boys—and there are several hundred of them—is the man who has charge of the work. He employs and discharges, reprimands or punishes, as the occasion arises. But above all he sets out to win a boy's confidence. Mr. Geigle himself commenced as a messenger boy and worked his way up step by step to the manager's chair. Surely he knows just the conditions under which the boys work. On the other hand, the boys feel instinctively that he is their friend. To him they go confidently for assistance in any difficulty.

From the time the boy hands in his application every precaution is taken conscientiously by the company to safeguard him.

Between calls there is an opportunity to become expert with the typewriter and to learn how to use telegraph instruments. Every boy with any ability has an opportunity to work up to a responsible office position

Neatness and courtesy are valuable business assets. The rules presented to a new boy stipulate that his uniform must at all times be in perfect condition, must be clean, in repair, buttons all on, and coat kept buttoned. The company provides as many changes of uniforms as are needed to keep the boys up to

the standard in appearance, for which service each boy pays a small weekly rental. Three tailors are employed constantly to keep the uniforms clean and in repair. In the summer, washable blouses are provided instead of coats. The company maintains free baths for the boys, with free towels and soap.

Each boy is instructed in simple matters of courtesy. He is taught when and where to remove his cap. He is made to feel that he is identified with an important commercial house, and that his deportment should be such as to be worthy of his company. He knows that if he does not conduct himself properly he will be reported to the manager. His oversights are entered upon the index card, and adverse entries count against him when the time comes for promotion. In this practical manner the boy is taught that good manners bring their reward in dollars and cents.

Great quantities of clothes for messenger boys are kept in the stock room. Each new applicant is fitted with a suit of correct size. The necessary alterations are made in the company's tailoring department

The company also maintains a small circulating library for the use of the boys, a former messenger acting as librarian. Every boy in the messenger service is entitled to the free use of this library.

The company desires to assist every boy to fit himself for something better, if the boy cares to do so; and to further this object, a typewriter is placed in the messengers' waiting-room. Any boy is at liberty to practice upon it while waiting for calls. A set of telegraph instruments has also been installed, with an inside connection, so that any ambitious boy may learn telegraphy and carry on communication with another boy at the end of the line in the same room.

Especially commendable work which Mr. Geigle performs is in training his boys to be men. A messenger boy is subjected to many experiences which rarely come to the boy employed in a business house. The boy's honesty and integrity are tested hourly by the very nature of his service, and he himself is subjected to the wily approaches of those who would profit by his commissions. Thus the boy is compelled to be doubly fortified, first entrenched within his own consciousness lest he be tempted to do wrong; and secondly, he must be ever watchful for the temptation from without which would ensnare him and despoil his employers.

Among several hundred boys, it sometimes happens that one is not so careful or particular in some matters as he should be. This lapse is reported to the manager, and the boy comes before him for explanation. A boy is never discharged for a first offense, unless it be of a very serious nature. Instead, the manager talks it all over with him in the desire to be helpful rather than harsh. The boy is given an opportunity to try again in another location, from which reports are also made. Should the boy fail even a second time to progress satisfactorily he is given still another trial, with the earnest, patient counsel of the manager to show him the right course to pursue.

Making Weather Forecasts with Flowers

WEATHER conditions may be predetermined by means of a unique arrangement, easily prepared by anyone. Procure a bouquet of paper flowers. They may be made or purchased, but their colors must be pink and blue. Dip the flowers in a saturated solution of chloride of cobalt and allow to dry. Repeat the process five or six times; and place the flowers in a suitable vase.

When wet weather is approaching, the flowers retain their original colors, but when it is going to be dry, the pink flowers become purple and the blue ones turn green.

Bringing home the harvest. The sack contains turtles, weighing in all over a hundred pounds. They are sold by weight—shells and all

Turtle catching is an art in the practice of which the skilful use of special tools is an essential. The chances are very great that J. S. Bassler, professional turtle-catcher for American restaurants, caught the turtle that made your soup to-day. He does it with a long spear, digging the turtles out of their holes and throwing them into sacks for transportation on his own back to his wagon

Catching Turtles as a Business

DID you ever wonder where the turtle in your soup at the fashionable restaurant came from? Did you know that many of the buttons on your clothes were made from the backs of snapping turtles? In early September, when turtles are house-hunting among the pebbles and worms in the muddy bed of some fresh water creek, preparatory to sleeping away several months of cold winter weather, men are getting ready to wake them up in the middle of their nap by jabbing a steel hook into their backs. The work of hunting turtles, though it begins in the early autumn, continues all through the winter months.

The hunting of turtles has become a specialty with J. S. Bassler, who can boast of catching four and five tons every year. He uses a heavy steel rod bearing a hook at the end. Fitted with rubber boots and warm clothes, Mr. Bassler wades along the stream, jabbing the hook into the muddy bottom. Rudely awakened from his comfortable, ice-cold bed, the turtle is jerked out of the water on the end of the hook.

The turtle hunters usually select some country having numerous small streams. Here they pitch their tent and remain for several days, working within a radius of eight or ten miles from camp. After the streams are exhausted, they move on to another section of country. Sometimes five hundred pounds of turtles are found in the same hole, and thousands of pounds are caught during the usual stay in each camp.

The live turtles are placed in large bags and carried to the road where they are loaded in a wagon. A bag of turtles weighs between one hundred and one hundred and twenty-five pounds. The turtles are later packed in sugar barrels, one on top of another, each barrel weighing as much as three hundred and twenty-five pounds. They will live in this condition for many days. The chief markets, like New York and Chicago, pay from six to twelve cents a pound for turtles, including the shells.

Turtle soup is made from ordinary snapping turtles and not from green sea turtles, as gourmets fondly believe.

Why Logwood Is Worth $200 a Ton

THE great bulk of the logwood from all regions of its growth is used to obtain black dyes which result from its use with alum and iron bases. The use of logwood dates back over two hundred and fifty years, and from that time on the logs from Yucatan and Honduras have been considered far superior to those obtained from Jamaica and Santo Domingo. It may be of interest to note that the logwood tree is not a native of Jamaica.

The first shipment of logs that came into England in about 1550 was obtained at points on the Spanish Main and it seems that at first the dyers were unable to obtain durable colors. In order to protect the public the use of logwood was forbidden in 1581 by an Act of Parliament. The dyers in France and Germany, however, soon developed the use of logwood. After that English dyers were again permitted to use it, with the result that the demand for logwood began to increase. The wood from Campeche soon brought a price as high as $500 per ton, and that from Jamaica about $250. At the present time the Campeche wood sells for about $200 per ton and that from Jamaica and Haiti $100.

The world's present annual consumption of logwood is estimated at about 200,000 tons, of which the United States consumes approximately 30,000 tons. The import statistics for 1914 show that 20,000 tons of logwood came from Jamaica and about 10,000 tons largely from Haiti. The Bureau of Statistics of the Department of Commerce and Labor supplies the following figures in reference to the sources, quantities and values of logwood imported during 1910.

SOURCE	QUANTITY	VALUE
British Honduras	1,005 tons	$ 16,491
British West Indies	11,187 "	137,906
Haiti	19,022 "	200,544
Mexico	449 "	5,381
St. Domingo	434 "	3,914
Other Countries	221 "	4,212

The present bad condition of the dye trade in the United States has called forth numerous propositions for remedying the difficulties, but nothing practical has been done.

An Automatic Animal Fire Escape

BY the use of an automatic, animal fire escape just presented by a Western inventor it is possible to clear any size stable of animals in five short seconds. In the operation of this fire escape the element of chance does not enter. It has a positive action, and as all working parts are controlled by gravity there is nothing to get out of order at the critical moment. The value of an apparatus of this kind will be realized by anyone, for a fire seldom destroys a stable of any considerable size without a num- of the animals being lost. This results generally from the fact that the animals, frightened by the fire and smoke, become unmanageable and, if loosened, rush into the flames. The new device does away with all danger from this source and in addition provides a means of escape.

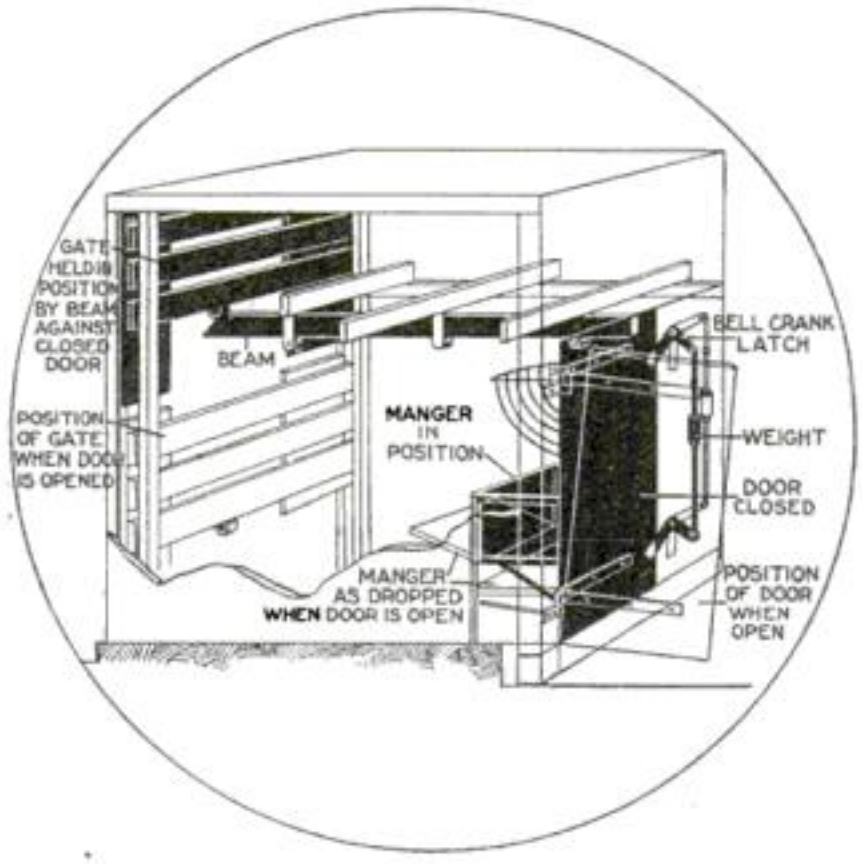
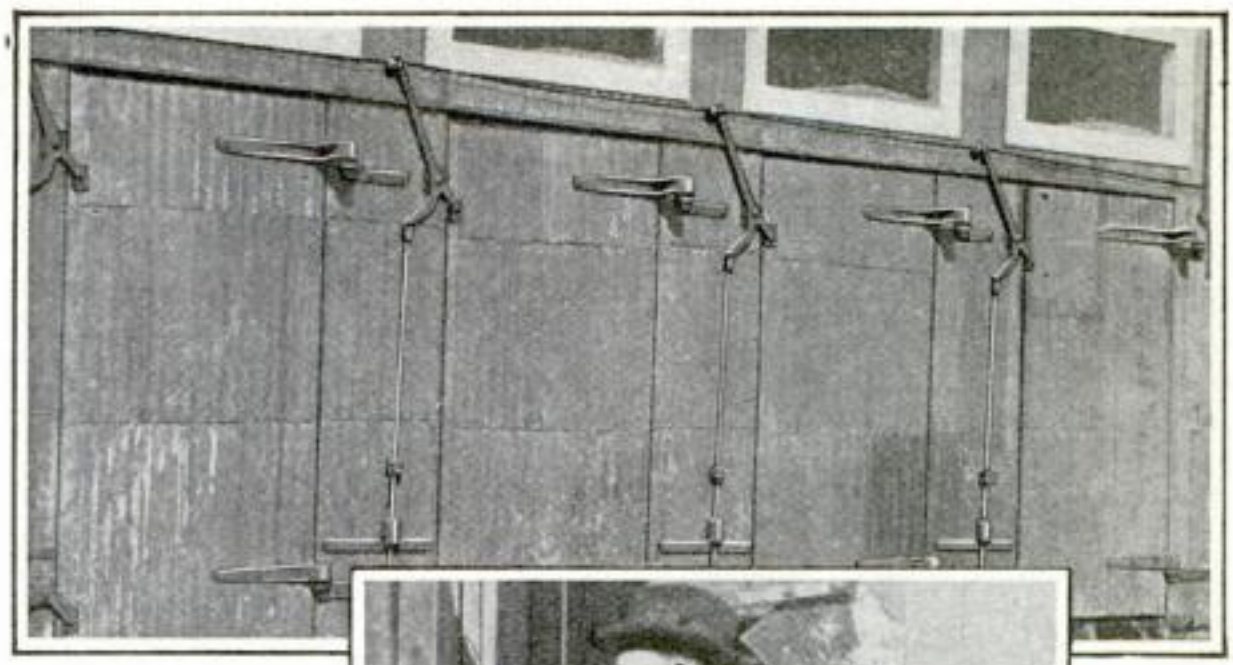


Diagram of the automatic horse fire escape. A gate drops, the manger collapses, and the halter is loosened when the outside fire-escape door of the stable is opened

When the fire escape is to be arranged, the stalls are located along the sides of the stable. Each is arranged with a door in the exterior wall, which is provided with a mechanism which at the same time that the door is held shut, holds up a gate above the open end of the stall, or behind the animal when the stall is occupied. A manger with collapsible parts is mounted in proper relation to the stall and a special halter is provided. Each manger is made up of two distinct parts—a front and a bottom. In the edges of these where they unite when in normal position is located a slot or groove, in the form of a one-inch hole, half of which is in the bottom and half in the front. Through this hole is run a one-inch rope, with a knot at its lower end and a ring at its upper end. When the manger collapses, the rope is instantly released and the animal freed. All working parts are operated by gravity. When the door, which is hung on gravity hinges, is unlatched it falls open, thereby allowing the bar which supports the rear gate to roll forward. This releases the gate, which drops, preventing the animal from backing into the stable. As the door is opened still farther the manger collapses and falls to the floor, the opening of the door having released the supporting rods. One large business house in Los Angeles, at the stables of which company the accompanying illustrations were made, has a series of ten of these escapes in one row. By a single operation, performed by hand or automatically, all of the escapes may be tripped, as shown on the opposite page.

If a fire breaks out, the device works automatically. This result is accomplished by running a cable along the interior of the building. This cable is cut into short pieces and connected with fusible links, these being placed as near to the woodwork as possible. From the interior the cable is run through the outside wall close to the lever which operates the fire escape doors. The end of the cable is then attached to a trip to which a weight is fastened, this weight also being connected to the lever which releases the door latches. In the event of a fire the cable separates, on account of one of the fusible links being melted, this releasing the trip which allows the weight to pull down the lever and which, in turn, automatically releases all of the fire doors. This device is the invention of John Betty of Los Angeles.

Solidly locked when not needed, the outside doors of the stable are held shut by triggers connected with a shaft which runs the length of the building and is operated by a single lever. The device can be arranged to operate automatically in case of fire. In this case a weight lifts the lever —the weight being released when any of the fusible metal sections of a cable are burnt out in any part of the stable



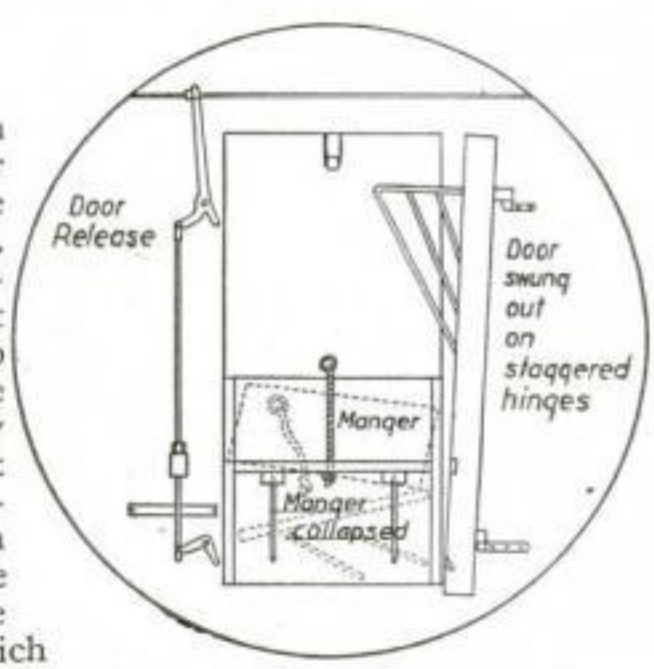


Diagram of door release system. The timber at the top of the doorway is a shaft connected with the gate at the rear, which closes as soon as the outside door is opened

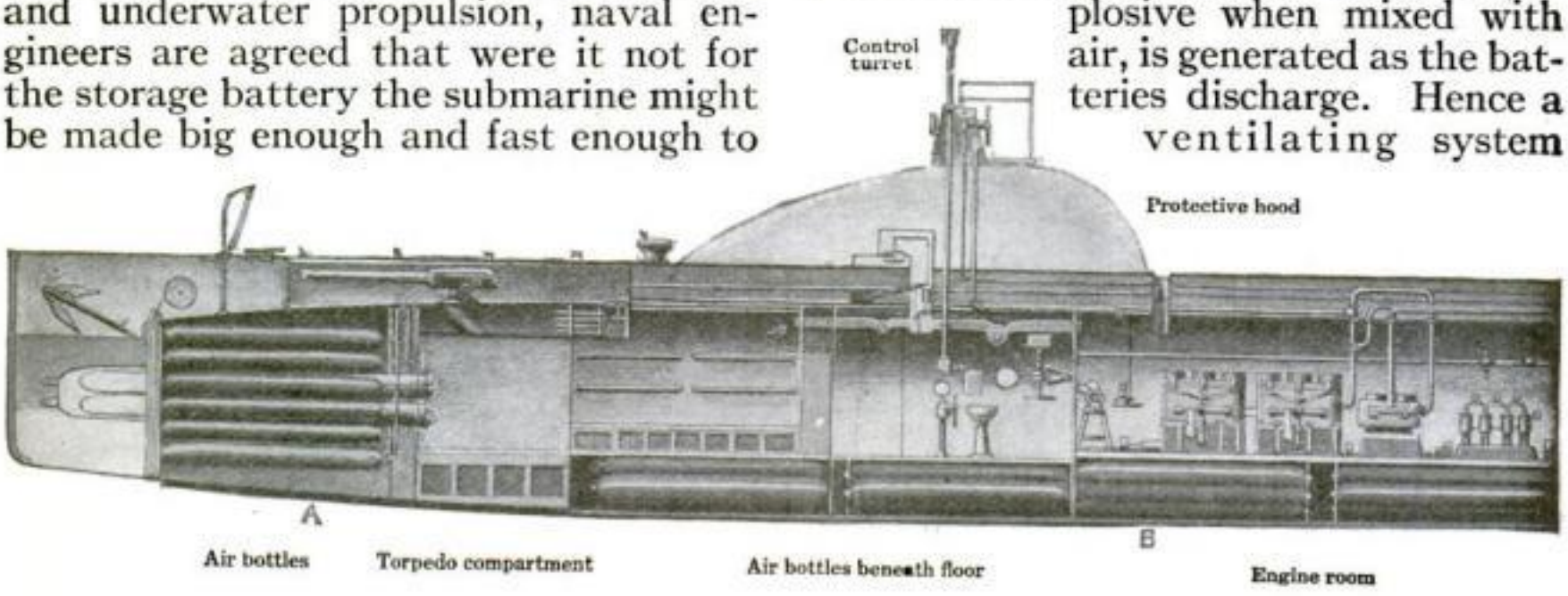
A Stable Door Which Opens When a Fire Breaks Out

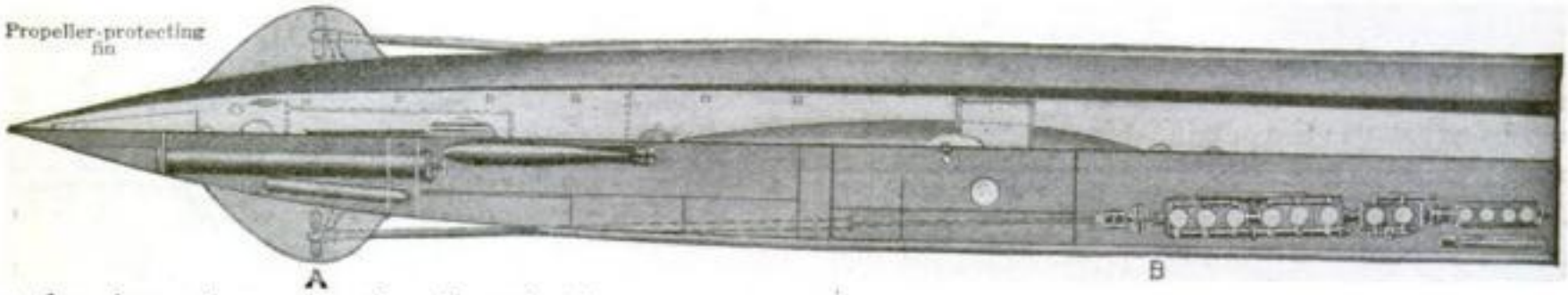
When the door, which is hung on gravity hinges, is unlatched, it falls open. When released, the gate drops and the animal is prevented from backing into the stable. As the door is opened still farther the manger collapses and falls to the floor, the opening of the door having released the rods which support it. This all occurs in an instant. The animal is forced to move out into the open air

Doing Away with the Submarine's Storage Battery

TERRIBLE as the submarine seems, it could be made still more terrible if it were propelled by a system simpler than that at present employed. Although no perfect engine has yet been found which is suitable for both surface and underwater propulsion, naval engineers are agreed that were it not for the storage battery the submarine might be made big enough and fast enough to take its place in the battle-line of a high-sea fleet. Some day we may see squadrons going into battle accompanied by submersible vessels of huge dimensions, which will have armored decks and which will be capable of making speeds of twenty-five knots and more. Compared with the battle possibilities of these future craft even the largest of present German U-boats will seem puny and toy-like in comparison. But before we shall see them the present type of surface propelling-engine must be vastly improved, and above all the storage battery must be abandoned.

An oil or any other internal-combustion engine cannot be employed to drive a submarine under water because of the poisonous gases generated and because it breathes air more voraciously than any human being. Hence an electric motor, deriving its current from a storage-battery, is installed on every submarine for underwater propulsion. The weight of that battery is about three hundred and seventy pounds per horsepower per hour. Hydrogen gas, which is in itself not poisonous, but which is highly explosive when mixed with air, is generated as the batteries discharge. Hence a ventilating system must be provided. In the lead-type of battery, which is in use side by side with the Edison nickel-iron cell, the greatest care has to be exercised to exclude salt





Eliminating the Storage Battery from the Submarine—the Neff System

These drawings are a longitudinal vertical section and a sectional plan of the Neff system. The two small cross-sections at the bottom are taken through the points marked A and B below the two larger drawings.

Both the forward and aft compartments contain steel bottles in which air is compressed at 2,500 pounds pressure; other air bottles are placed beneath the floors. The engines drive propellers near the bow of the boat. Protecting fins guard the propellers from injury.

The engine-room is supplied with air in two distinct ways; one for surface running and the other for submerged running. The superstructure is open to the sea and serves to hold a considerable amount of air after the submarine has begun to submerge. This trapped air is automatically fed to the engines for the first few

water; if that should come into contact with the liquid of the battery, chlorine gas—the poison gas of European battlefields—would fill the vessel.

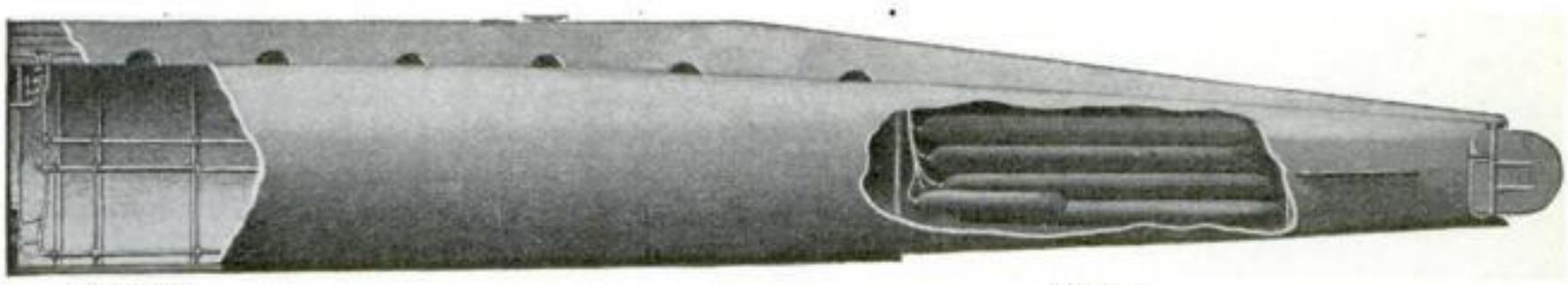
Although the Edison cell will not generate chlorine, even if salt water should leak in, it does generate an excessive amount of hydrogen when discharging. Whatever type of cell may be installed the storage battery is heavy, cumbrous, dangerous and very limited in the amount of power that it is able to deliver.

Realizing that the submarine must be freed of the storage battery, the Navy Department has taken a great interest in what is known as the Neff system of submarine propulsion, which takes its name from Abner R. Neff.

About three years ago a California company spent about $130,000 in completing a submarine boat, seventy-five feet long and seven and one-half feet in beam. It was driven only by oil engines; it had no storage battery at all. In order that the crew might live despite the poisonous gases given off by the engines, a compressed air ventilating system was installed. The six men on board stayed under water thirty-six hours—a record submergence.

It was in this boat that Mr. Neff became interested. He made improvements of his own and engaged engineers to contribute their ideas. A trial board appointed by the Navy Department approved of the ventilating and propulsion system. The only objections which have been raised to the system are military in character. Against the Neff system it has been urged that large quantities of air would be emitted, when the submarine is running under water; a wake of air bubbles would be left on the surface to betray the craft and to make it easy to follow its submerged course. Another objection is the noise made by the Diesel engines under water; the pounding of engines and air compressors could easily be picked up by sensitive sound-receiving devices.

As might be supposed, the inventors of the Neff submarine system are ready with replies. They point to the manner of handling the exhaust from the engines—indicated in a general way in the accompanying illustration. The burnt gases are led to a system of condensing tubes outside of the hull. The expanded gases, having been condensed, are drawn



minutes—a feature of importance when the submarine is cruising at the surface in a heavy sea and the atmospheric air-feed may be cut off momentarily.

The air bottles are tapped as they are needed. A high-pressure airline leads from these bottles throughout the vessel; the high pressure system in turn supplies a low pressure system of pipes. As soon as the atmospheric air-feeding devices have been cut off the air pressure within the vessel drops; and this drop is utilized to cause the feeding of air automatically from the stored supply.

The exhaust from the engine passes out through an exhaust manifold from which an exhaust-pipe leads, discharging beneath the propellers. Mechanical exhausters are also provided in case the water pressure is so great that the natural suction effect produced by the travel of the vessel through the water is insufficient.

inboard by mechanical exhausters and in turn pumped overboard. Underneath the hull the exhaust is sprayed out and carried back to the propellers. If there are any bubbles left they are churned up by the propellers as by an egg-beater. Thus the betraying wake left by a train of air bubbles is to be eliminated.

The noise from oil engines under water, to which objection has been raised by naval officers, is caused by a final expansion of gas, after it leaves the cylinders, from a pressure of about fifty pounds down to atmospheric. This is accompanied by rapid sharp reports and a reverberating roar. In the Neff system it is claimed that the exhaust is silent, because the engine is exhausted into a condenser or a closed chamber from which it is drawn at a partial vacuum and discharged overboard at nearly the outside water pressure. The remaining noises are due to the movements of the machine parts, such as the clicking of valves. All this noise, it is claimed, may be reduced by proper regulation and adjustment. In testifying before the Committee on Naval Affairs of the House of Representatives, Mr. Neff pointed out what the POPULAR SCIENCE MONTHLY has already shown—that the characteristic hum of an electric motor can be picked up at a distance of fifteen miles by microphones and that this hum is easily distinguished from the vibration of engines. Hence there is just as much objection to the electric motor as to the Diesel engine under water.

Whether or not the Neff system will be adopted by the United States Navy no one can say. The Navy is frankly interested in the project, but, following the usual government policy, it prefers to adopt the system only after it has been completely developed by some private company. About $300,000 have been thus far spent on the system. Its promoters are unwilling to make any further sacrifices. Here we have a good example of the use of a Naval Advisory Board. The Neff system may not be perfect; but it has assuredly commendable features enough to justify the Board in carrying on the further development with government funds. If private companies were to wait for inventors to submit commercially perfect devices we would have no tungsten lamp, no harvesting machinery, no electric motor. All new inventions are crude. They must be regarded as material for development by laboratory engineers. Not until the government assumes that attitude are we likely to improve our fighting machinery.

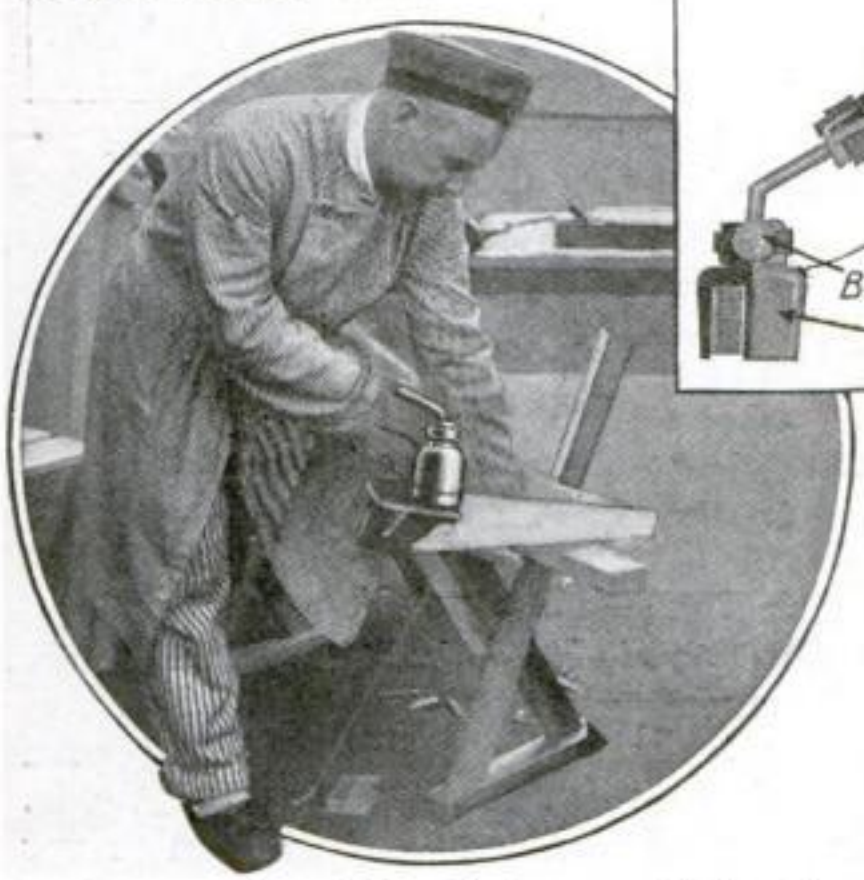
The llama of South America corresponds to the camel of the East as a beast of burden in the desert regions of the Andes

Llamas as Powder-Carriers

IN the semi-desert Andes countries the llama is the general beast of burden, corresponding to the camel in the Old World. The photograph shows a troop of these singular animals transporting American powder to an interior Bolivian mining district, far from any railroad. The llamas are heading for the Andean Mountain passes, led by a reliable old bellwether. Two or three gauchos (herdsmen) will manage a bunch of fifty or sixty animals; for the creatures give little or no trouble unless overloaded.

The Electromagnetic Hand for Armless Veterans

AT a meeting of the *Verband Deutscher Elektrotechniker* (Association of German Electrotechnicians) the suggestion was made that the *Verband* consider the design and development of artificial arms, equipped with electromagnetic seizing and holding mechanism. The underlying idea is simply this:



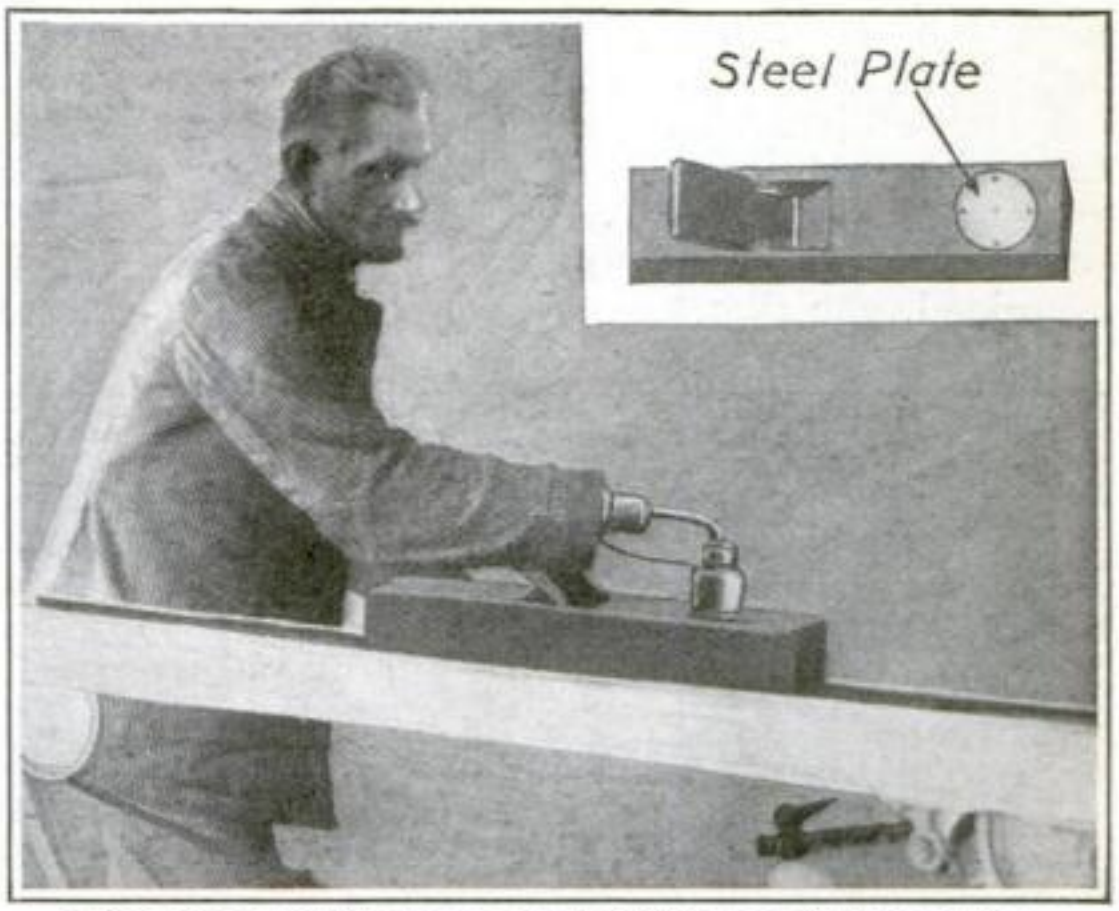
Construction of the electromagnetic hand. To the left, how the hand is used in sawing

The sleeve enclosing the stump of the arm is provided at its outer end with a pot-shaped or bell-shaped magnet, which can be adjusted or held in a ball-end socket, so as to bring the retaining face of the magnet to any position desired. The magnet may then be either clamped tight or else left movable against slight resistance. The pot-magnet is connected with a current supply by means of a screw-plug. Connection is made by moving some other part of the body, for example the foot, the chin, the remaining arm, the damaged arm itself, or even the whole body.

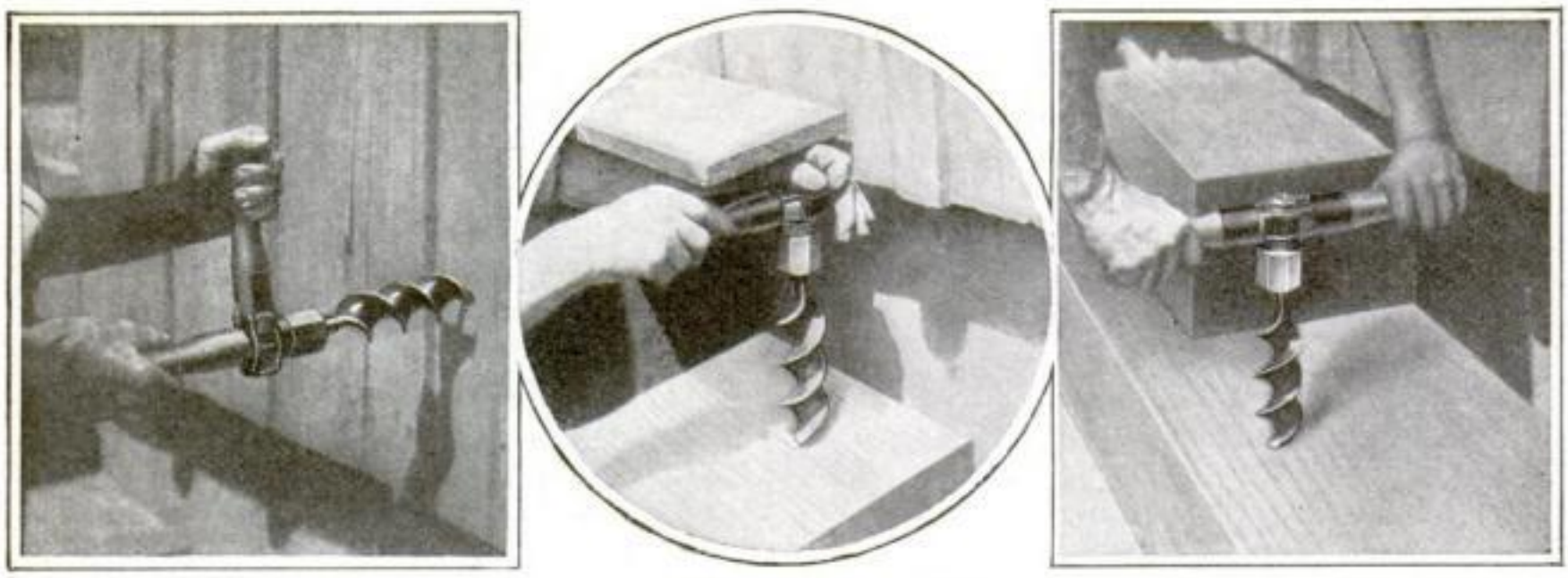
The pot-magnet makes it possible not only to grasp all iron objects, but also to hold them tight or to lift them and move them for any length of time. During these manipulations the connection between the stump and the object (tool) is not a rigid, but a movable one. For this reason the magnetic hand may be used by all workmen who work with iron tools or iron articles. As a rule, the tool need not be specially altered or given a special shape for the mutilated man, since the magnetic hand is capable of grasping the tool at any place, provided it is made of iron.

In filing, for instance, the magnet is placed on the outer end of the file. The file is moved exactly as if it were guided by a healthy arm; for the magnet can move relatively to the sleeve. A carpenter's plane is provided at its extremity with a small iron disk and is manipulated in exactly the same manner as any other plane. Stampings cut out by machine dies can be removed perhaps with greater ease than with a normal hand.

Still other grasping movements, for instance a pinching movement, may be carried out without difficulty. Even the delicate closing movement of a pair of pliers may be effected.



The plane must have a piece of steel on its upper face so that the electromagnetic hand may have a hold



A new auger which will work in any position and around almost any obstruction. It can be used in a corner, under a shelf, or even inside a box with equal facility

An Auger that Works Anywhere

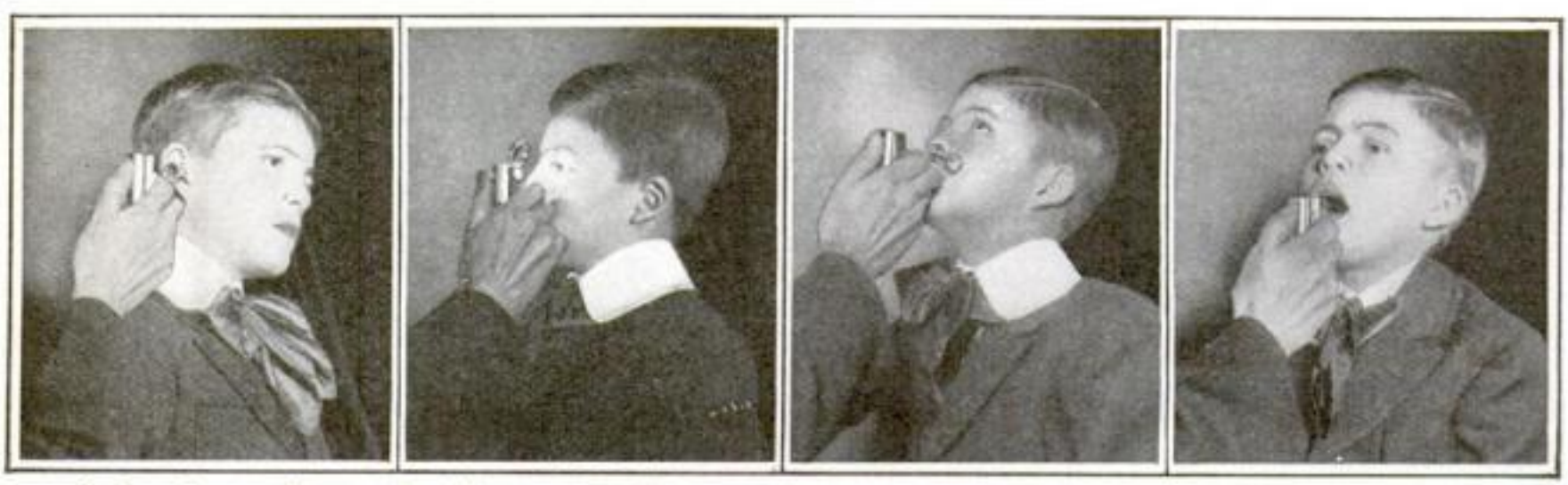
A NEW auger that will work in any position has been invented by Wm. H. Stiner, of Kennett Square, Pa. The chuck is made to take a tool of any size up to 2-inch. The great value in the device is that it will be of use in so many difficult places, it can be placed between two rafters and used to bore a hole, and the handles can be taken out and placed in other positions at will, thus enabling the operator of the tool to do many difficult jobs that could not possibly be undertaken with the ordinary tool.

Handy Instrument for Physicians

AN instrument for making diagnoses in the case of injured eyes, ears, noses or throats has been designed for physicians and nurses, and it is so small and compact that it can be easily slipped into the vest pocket. A nickeled case contains a cell or dry battery which lights a miniature lamp. By the use of various attachments, the ear and nose can be examined, the diseased or injured portion being magnified by a small glass that is attached. By means of a strap, the instrument can be fastened to the front of the head for use by the surgeon in emergency operations.

Ice Dynamited so Yale Crews May Row

THE Yale crews began practice early in March on the Quinnipiac River, but not until a path was cleared with dynamite through the solid ice fields. The condition of the frozen river annoyed Coach Guy Nickalls. The rowing instructor had to contend with work in the gymnasium for the varsity oarsmen until he ordered practice on the water, which was then one immense sheet of ice. For the first time in the history of rowing in this country dynamite was brought into play. Nickalls organized a blasting squad consisting of Mather Abbott and Charlie Wiman. When the coach's dynamite crew finished their work a long lane had been cleared for the shells.



A handy appliance for diagnosing diseases of the eye, ear or throat. An electric light illumines the parts and a magnifying glass aids in the examination

Embalming a duet by Lina Cavalieri and Lucien Muratore. Cavalieri was formerly a member of the Metropolitan Opera Company. Muratore is a distinguished Italian tenor. The photograph shows in a general way how songs with orchestral accompaniment are recorded. Sometimes the phonograph projects through a partition, so that the singer sees only its mouth. Often five or six phonographs are used simultaneously to make records. In making master records, the artists always sing twice

Singing for the Phonograph

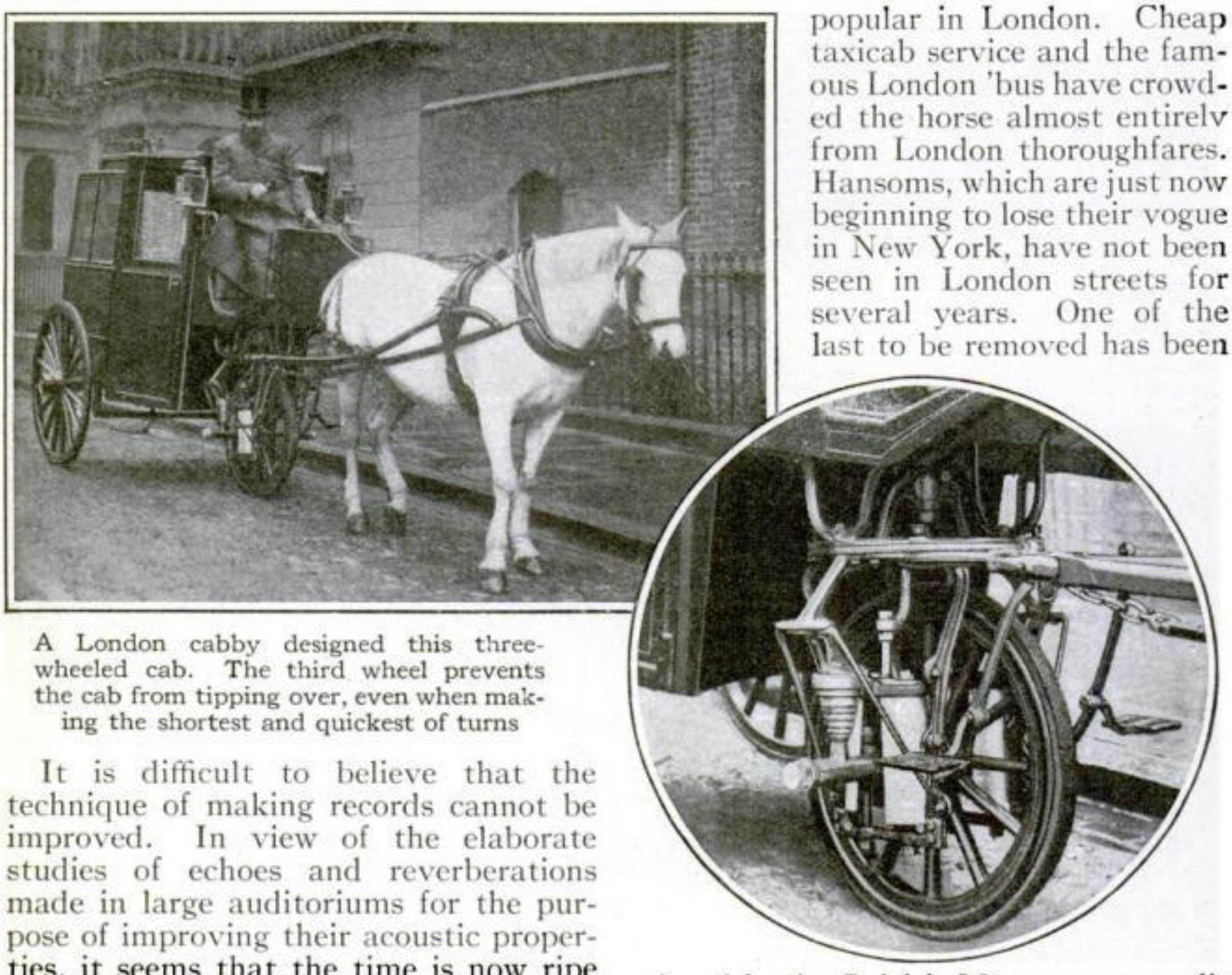
THE recording of the human voice on the phonograph is almost a science in itself—not so much as the artist is concerned as the laboratory head who is responsible for the clearness of the ultimate record. While each phonograph company has its own system of arranging the recording phonograph relatively to the orchestra and artist, the essential principles are very much the same in all laboratories.

As a general rule the musicians are perched midway between floor and ceiling, with their instruments pointing toward the horn of the recording phonograph. Men who play the tuba and similar brass instruments turn their backs to the phonograph so that the mouths of the instruments may project their growls and blasts toward the horn. In order that the tuba players may see the conductor of the orchestra, mirrors are placed in front of them, which reflect the movements of his baton.

For violin solos, an ordinary violin is used, the artist usually playing directly in front of a horn projecting through a partition. This is true of chamber music and all records in which the violin tone can be heard with sufficient distinctness. In heavy orchestral pieces, however, a special instrument called, after its inventor, the Stroh violin, is used. It seems that the sounds of the ordinary violin are difficult to produce, especially at a distance. Stroh devised a violin which has no sounding-board. It comprises simply a bridge, over which the strings are stretched in the usual manner, and a horn which amplifies the sounds. This instrument is now used in all phonograph laboratories. On the finished phonograph record its sounds are hardly to be distinguished from those of an ordinary violin.

Many experiments have been made to determine the best shape of room in which to make records. Edison, for example, tested almost every conceivable form. He even went so far as to build a room in the shape of a horn, the small end of which terminated in the phono-

graph itself. The singer stood practically upon the edge of this huge horn's mouth, for such was the room. The results were no better than those obtained by stationing the singer in front of an ordinary phonograph in an ordinary room. As a result we find that no special effort is made by the phonograph companies to utilize rooms of special shape so as to gather all sounds and concentrate them upon the record.



A London cabby designed this three-wheeled cab. The third wheel prevents the cab from tipping over, even when making the shortest and quickest of turns

It is difficult to believe that the technique of making records cannot be improved. In view of the elaborate studies of echoes and reverberations made in large auditoriums for the purpose of improving their acoustic properties, it seems that the time is now ripe for a new series of experiments which will show how those sounds may be gathered which are now lost.

The record made by the artist is called a master record. In fact, two records are made, one being hermetically sealed and stored away in the company's archives for future generations. The other record is used for the preparation of a die for making commercial records.

This Cab Simply Can't Tip Over

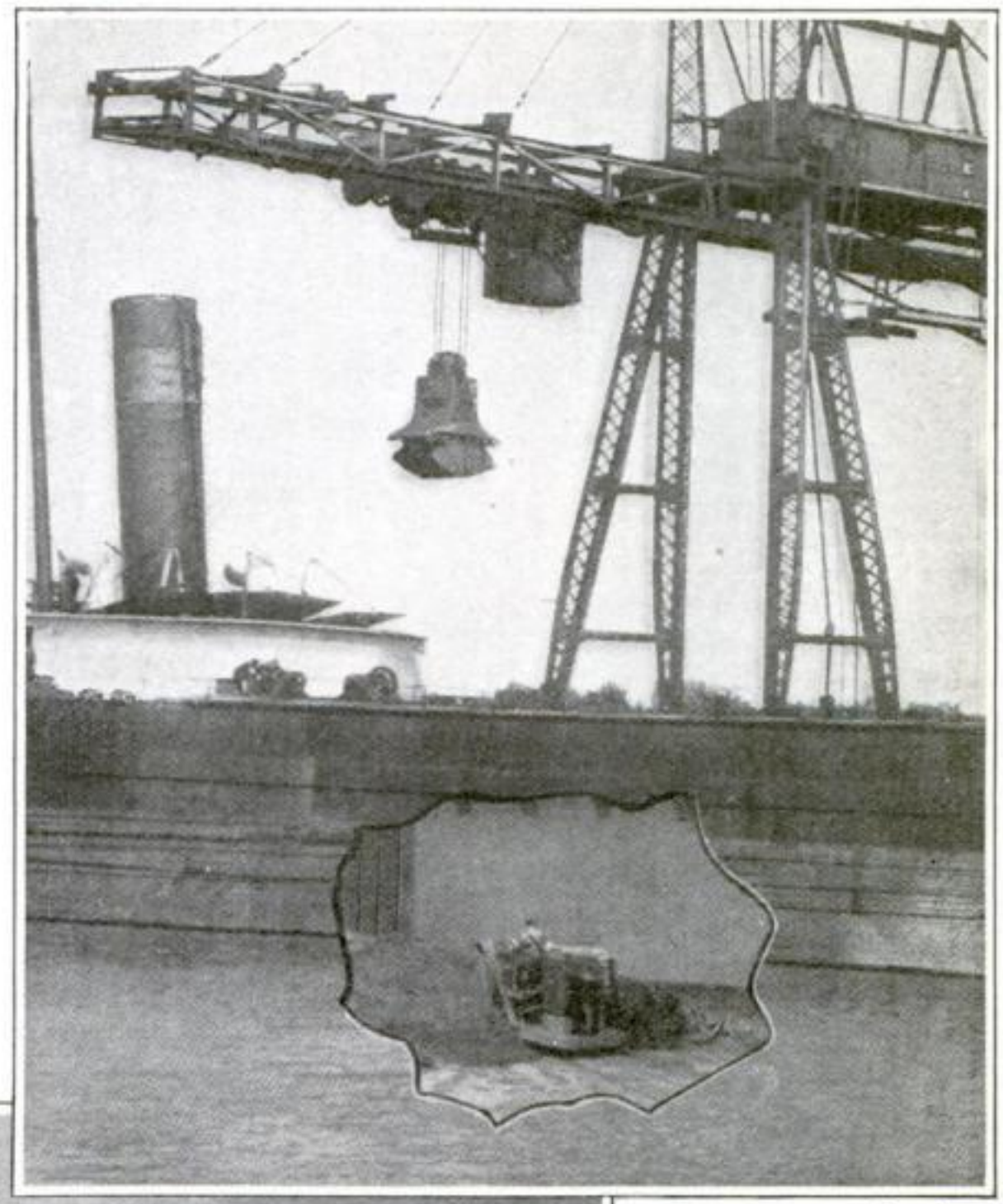
A CITY cabman of London has devised and built an attachment in the form of a third wheel for his cab, which, he claims, adequately prevents the cab from upsetting, even in going around the sharpest and swiftest of curves. The additional wheel is placed under the driver's seat, almost in dangerous proximity to the horse's heels. It is fitted with springs on either side and performs the incidental function of absorbing jars and jolts. Even in spite of the added factor of safety which the third wheel provides, it is doubtful if the cab will continue to be popular in London. Cheap taxicab service and the famous London 'bus have crowded the horse almost entirely from London thoroughfares. Hansoms, which are just now beginning to lose their vogue in New York, have not been seen in London streets for several years. One of the last to be removed has been placed in the British Museum as a relic for future generations to gape at.

Gasoline in Bulk for Panama

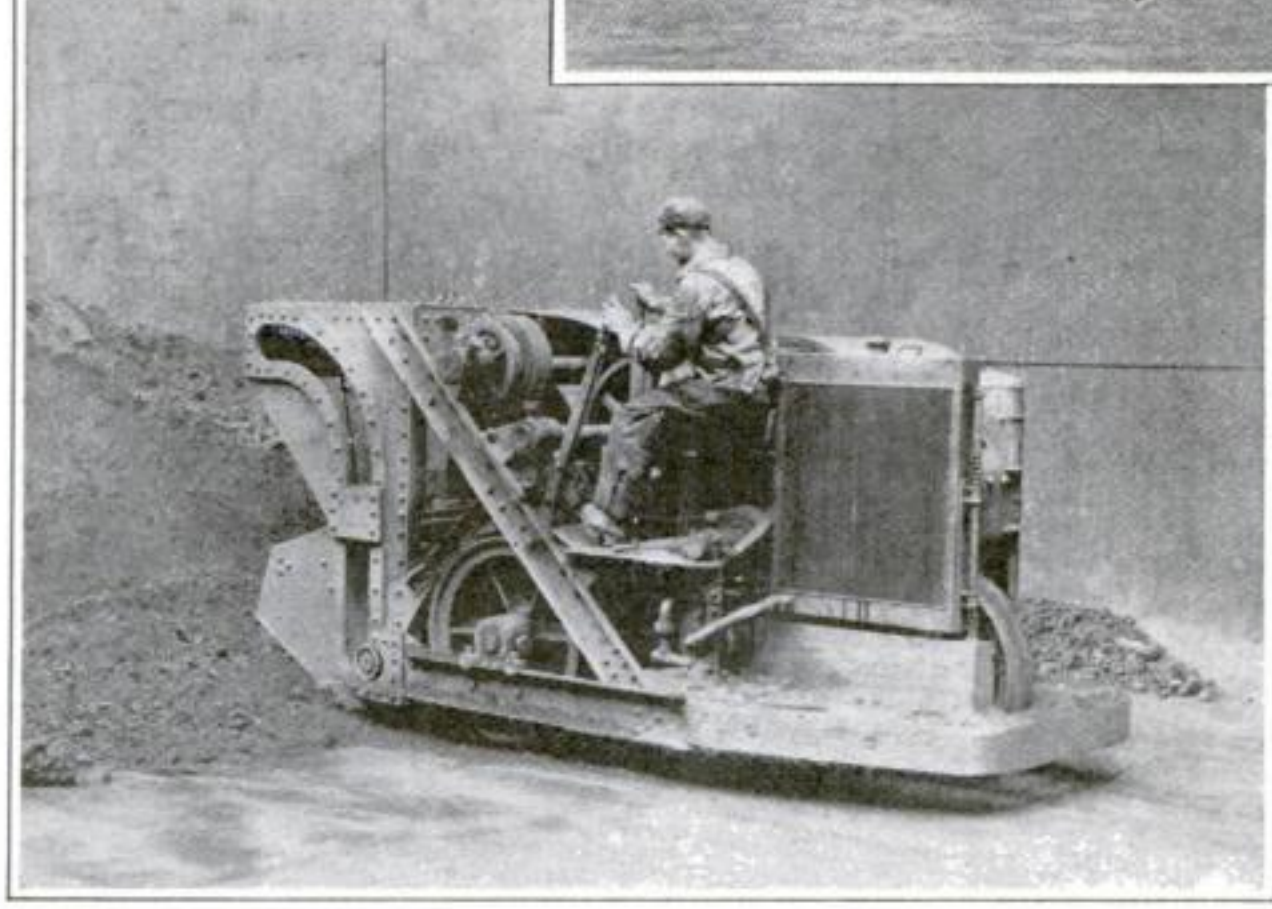
GASOLINE is being shipped in bulk to Panama. The first consignment arrived at Balboa in February and was unloaded into the new storage tank recently erected by the Panama Canal Commission. In Panama there is now stored fuel for ships of all sorts, gasoline, crude oil and Diesel oil. Considerable gasoline is still on hand in Panama in drums, the supply being sufficient to last at the present rate of consumption about five months.

Machine Shovels Faster Than Forty Men

ON the Great Lakes, where bulk cargoes of coal and ore make up the majority of loads carried by the giant freighters, one of the greatest factors of loss is that occasioned by the difficulty in gathering together the last remnants of coal or ore which remain in the out-of-the-way nooks and corners of the hold and which the unloading machine cannot reach. When the piles of ore or coal have been diminished so far that the bottom of the hold is in sight, the customary practice is to send gangs of men with shovels to shift the piles into the convenient reach of the power-shovel, or "bucket" as it is called.



The scraper-shovel quickly sweeps out the corners unreached by the lifting-bucket

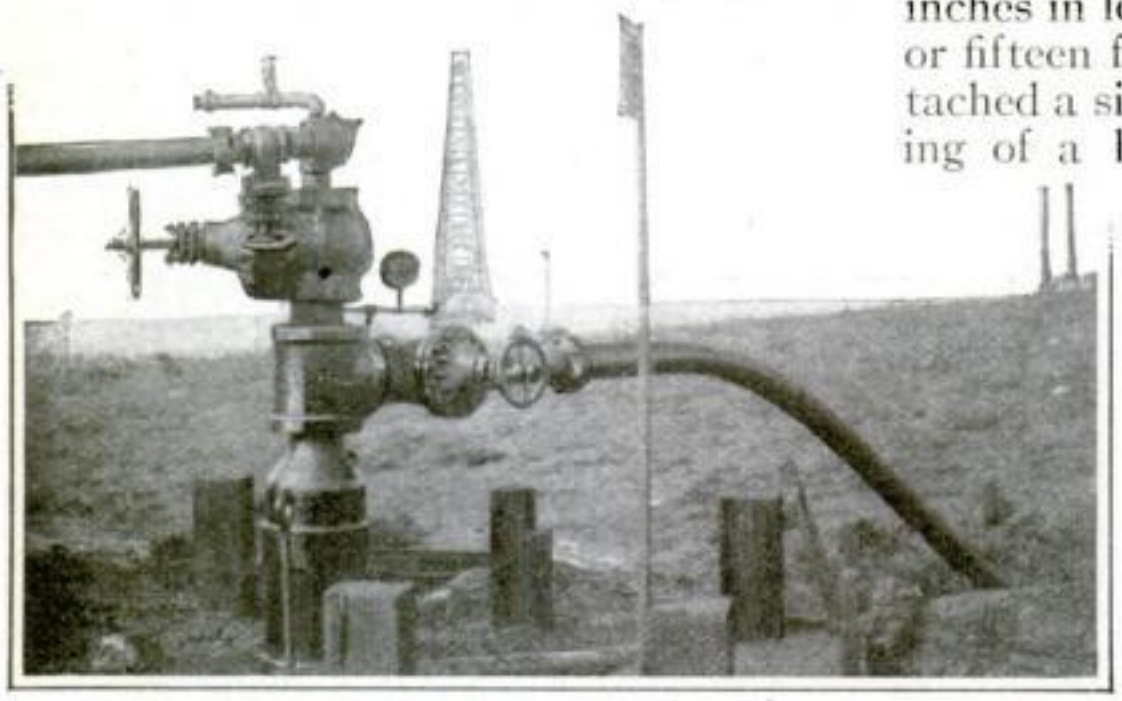


A sturdy "shover" which pushes coal or any other loose material into big piles under the hatches. The steam shovels can then hoist full buckets

To do away with this waste of time, a Cleveland concern has brought out a machine which takes the place of the shoveling gang. The machine does the work of about forty capable shovelers. On one occasion, the automatic shoveler moved one hundred tons of ore into the path of the bucket, approximately in two hours less time than the hand gang formerly required. The machine consists of a high-powered gasoline engine operating a lift-shovel at the front of the machine. When the shovel is raised as far as it will go, it is turned over in a dumping position and the load discharged. The wheels are fitted with rubber tires.

Gas Flows Back to the Earth

IN the Midway oil-field of California natural gas is being returned to the earth from one pocket to another. Two flowing oil wells on this lease produce a considerable quantity of gas along with the oil. Already there is more gas than is needed for fuel or domestic purposes in the field. Instead of permitting this gas to go to waste it is carried by pipe lines to a hole that was drilled for oil several years ago. Under natural pressure the gas finds an outlet at about five hundred feet. Apparently it is being stored away in underground reservoirs at that depth.



Too much natural gas is obtained from a California oil-field. For that reason it is piped back into natural underground reservoirs for future use

Buying Telephone Poles by Weight

SOME of the telephone and telegraph companies have adopted a plan of weighing poles which they buy as a means of ascertaining just how well seasoned they are. Men who are experienced in handling poles are able to calculate with a remarkable degree of accuracy the approximate weight of a pole that has been properly seasoned. Should a pole prove to be much heavier than their estimate, it has not been properly seasoned as a general rule; the over-weight is due to the presence of sap in the wood.

The accompanying illustration shows a weighing device which is utilized by one concern. A tripod supports a long lever, the short end of which is a few inches in length and the long end twelve or fifteen feet. To the short end is attached a simple weighing device consisting of a balance-arm and sliding and fixed weights. Hanging from this by means of heavy chains are two sets of wood tongs.

The pole is slid between the tripod to such a position that its weight will be about evenly distributed on either side. The points of the tongs are embedded in the wood, then the long arm of the lever is brought down and the pole is lifted from the ground and its weight ascertained. The leverage is so great that one man is generally able to lift the average pole.

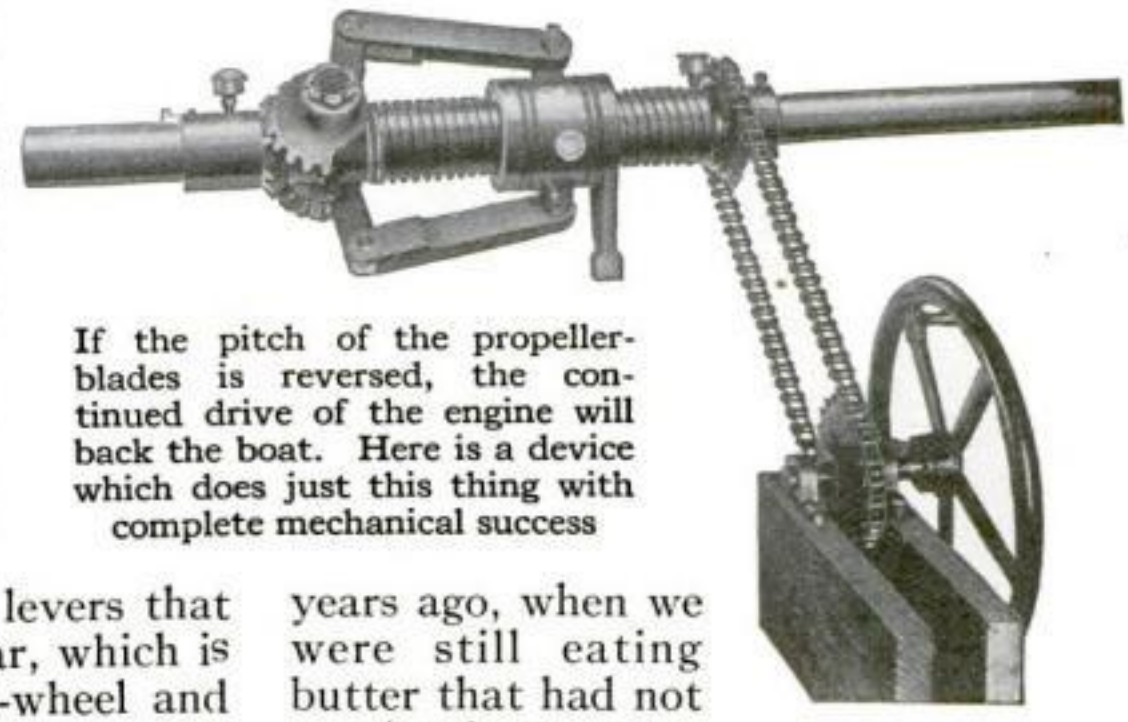
Only the well-seasoned poles are dipped in the preserving bath. This bath adds greatly to the life of the base of the pole, as the chemical, which is kept hot by a fire beneath the vat, enters every pore and crack in the base.

THE East will have to look to the West for progressive ideas. Palo Alto, California, a town of about 7,000 population, has a town incinerator of a daily capacity of 30 tons of mixed refuse.

Before dipping in the preserving bath, telephone poles are weighed to determine whether or not they are well seasoned

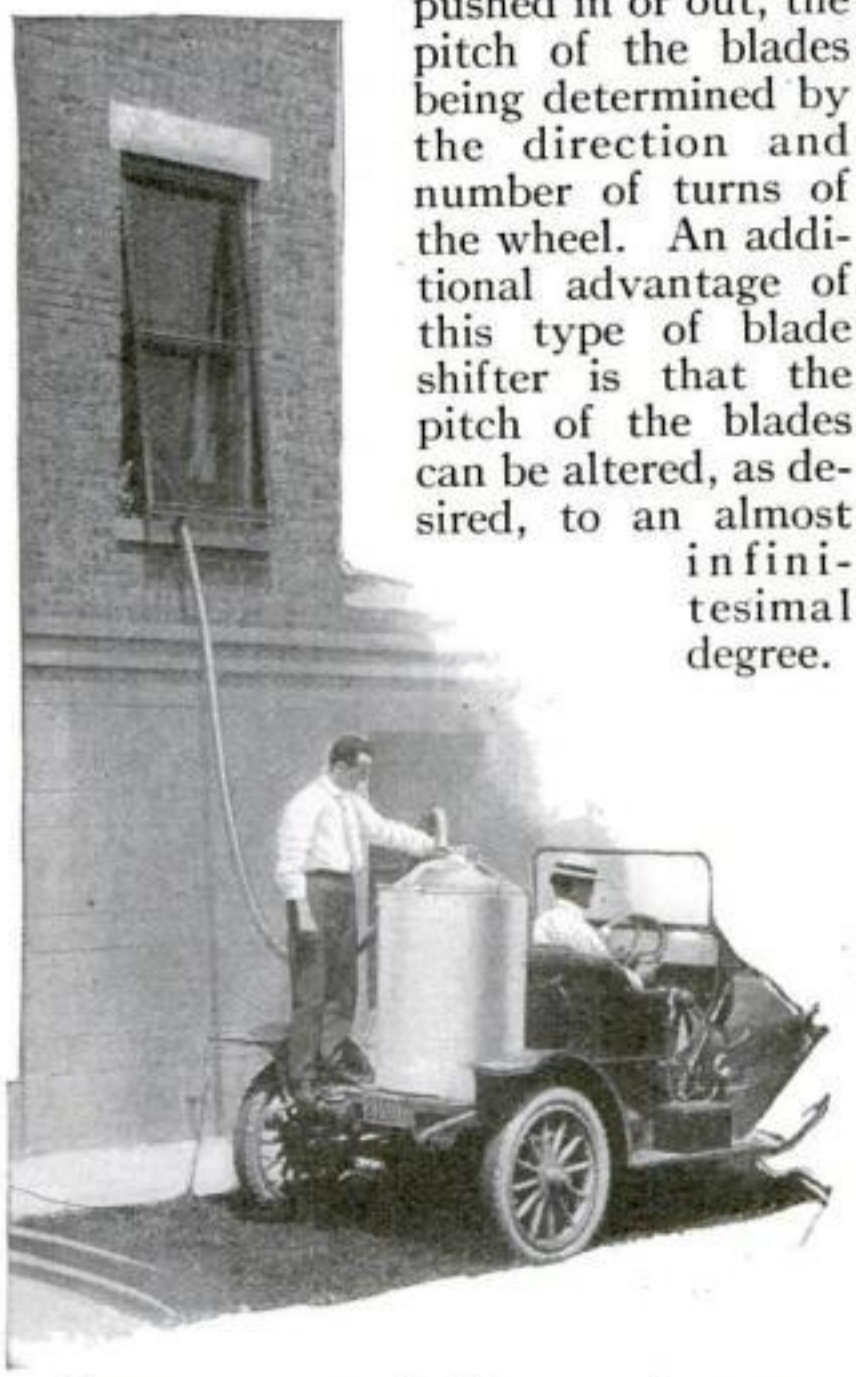
Reverses Tug's Propeller-Blades

WITH small boats, the quickest and surest way to back-water is to reverse the pitch of the propeller-blades. Numerous motor-boats are equipped with mechanism which performs the task by the mere shifting of a lever, but in the case of larger craft the blades of the propeller are so heavy that to reverse them by an ordinary lever would be almost impossible. A large tug that plies San Francisco Harbor was recently equipped with a propeller-blade reversing mechanism, which, while embodying the old lever principle, accomplishes its purpose in a surer and more ingenious way.



If the pitch of the propeller-blades is reversed, the continued drive of the engine will back the boat. Here is a device which does just this thing with complete mechanical success

The blades are shifted by levers that are controlled by a worm-gear, which is in turn operated by a hand-wheel and chain. When the wheel is spun, the worm revolves, causing the levers to be pushed in or out, the pitch of the blades being determined by the direction and number of turns of the wheel. An additional advantage of this type of blade shifter is that the pitch of the blades can be altered, as desired, to an almost infinitesimal degree.



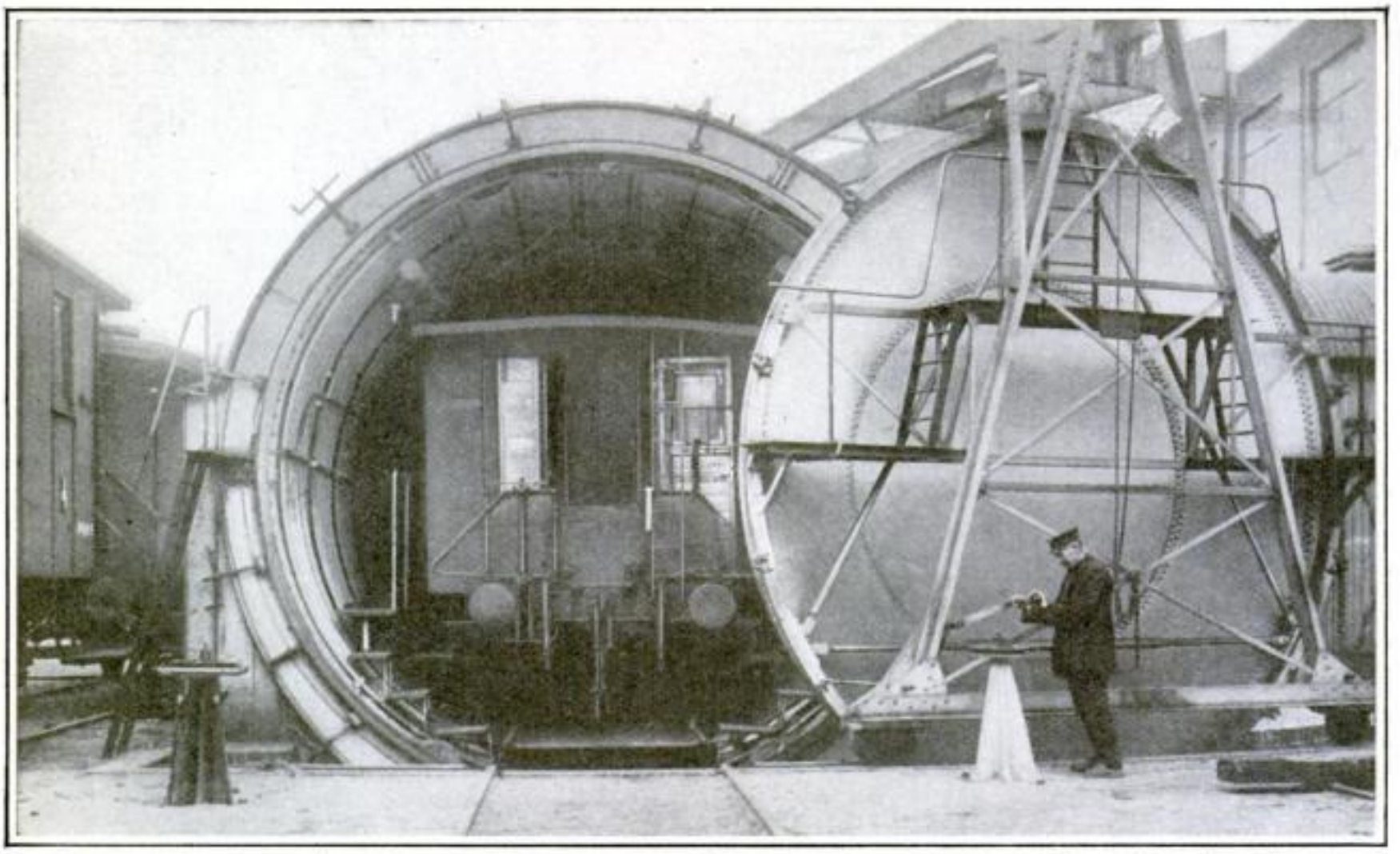
Cyanogen gas carried to your door—or window—to fumigate your house

Fumigating Has Improved, But Are We Less Afraid of Germs?

IN these days of sanitary living, sanitary breathing, sanitary sleeping, sanitary eating, etc., fumigation has come to be one of the most popular of indoor medical sports. Not a great many years ago, when we were still eating butter that had not previously gone under the vigilant microscope of the health officer, we considered that a little block of sulphur burned in a room after someone had had measles would annihilate the last germ. Not long ago, however, an enterprising physician somewhere in the United States examined a sample of wallpaper that had been on the wall since a case of diphtheria had run its course there a score of years before. On the sample he found an agile, active colony of diphtheria germs. This was not the sole cause, but it was one of the immediate causes of wide-spread, better fumigation.

Cyanogen, deadliest of gases, is now smoked into a room in which patients having contagious diseases have lived. The latest and one of the most effective ways of dealing death to the lurking microbe depends on a tank fastened to the rear of an automobile. The automobile is driven up alongside the house to be fumigated, a hose is attached to the top of the tank and led into the room.

Structurally, the automobile fumigating machine is highly interesting. An electric motor, attached to an air-pump, is started in the bottom of the tank, causing air to be forced through the mixture of chemicals. This air draft carries the death-dealing gases through the tube into the room.



To protect themselves from Russian vermin, the Germans are disinfecting all trains from Russia. Large cylinders, into which railway cars are run, are closed by tight end-covers, whereupon poisonous gases are turned on

Fumigating Tank That Contains a Railway Coach

EVERY railway train which returns to Germany from Russia is usually so infested with vermin that the German Government, in self-preservation, has had to resort to wholesale fumigation methods.

Fumigating tanks so large that standard-sized railroad coaches can be rolled into them, have been installed by the government at several railway centers. When the car has been placed inside such a tank, gigantic steel disks are clamped tightly over the ends of the enormous tube and fumigating gases forced in. All germs lurking in the car are killed in a few minutes' time.

Twenty-eight box-elder shoots were planted in a square. They were bent and trained to form a garden-chair

A Nailless Chair Made by Good Soil, Fresh Air and Sunshine

HERE is a chair made by Mother Nature. Fresh air, sunshine, and fertile soil were her only tools.

In 1903 John Krubsack of Embarrass, Wis., decided to make a chair different from any he had seen. He planted twenty-eight box-elder shoots in a five-foot square. He watched over them carefully; for if a single shoot had died his plan would have been spoiled.

After five years the little shoots attained a height of seven feet. Mr. Krubsack was then ready to begin real work on his chair. He bent the tender shoots and then fastened them. When, after several years, the joints became solid, the owner cut the shoots and trimmed the branches.

The chair has eighty-seven joints, and weather conditions will never cause it to fall apart.

Spraying Concrete

THE important work of re-enforcing the levees along the Mississippi River was recently aided by the addition to the usual equipment of an apparatus which sprayed concrete into the crevices of the pavement and levee facing. A large tank containing a mixture of sand and cement was filled with compressed air and the mixture forced at high pressure from the mouth of a large funnel with such force that a permanent adhesion was made.

Courtesy of Professional Memoirs

Concrete sprayed from a hose filled pavement crevices quickly and efficiently

Motion-Picture Silhouettes

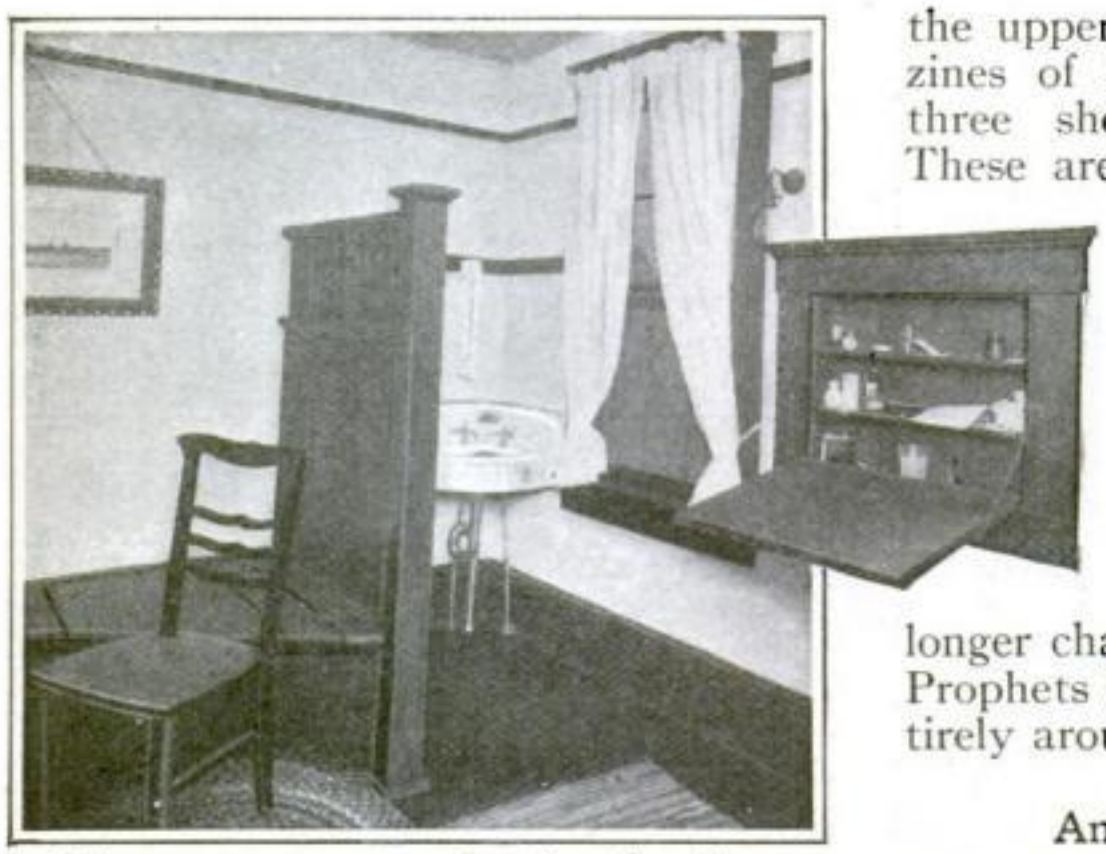
THE moving-silhouettes of C. Allan Gilbert's films are produced in a converted stable near Washington Square, New York city.

The coach-house has been fitted up like an ordinary motion-picture studio, with its inner walls done over in white. The lighting arrangements are such that the players are photographed in bold relief without any shadows.

The actors work on a stage which is as narrow as it is long. They pose in profile. Figures can be made to throw long shadows under a light, and this has been advantageously done when an actor is to appear double the size of his neighbor. The camera is placed in a pit, so that the lens is on a level with the player's feet. But should it not be possible to get over a situation unaided by the players, J. R. Bray, the animated cartoonist, comes to the rescue with drawings which match the genuine acting perfectly.

Moving-silhouettes are innovations in motion-picture photography. Novel effects are produced by so adjusting the lights that long, superhuman shadows are cast when a gigantic figure is to stalk on the screen

Space and Time-Savers for the Home



How a room was made attractive by a little home-built furniture

Bedroom Hid in a Living Room

CONVENIENCE and the saving of space are of prime importance in city flats and country bungalows. Here is an illustration which shows how comfort was brought to an ugly room that served as both bedroom and living room.

The addition of the wall-closet with its drop-shelf provided not only a writing-desk, but a cabinet for bottles and other small objects constantly in demand. When not in use as a desk, just that much space is saved. The built-in seat is utilized for a clothes-closet and it also screens the unsightly porcelain washbasin and its pipes. It is a simple matter to add a drop-shelf to a cabinet already built-in. One seen recently concealed an electric stove and an entire light housekeeping equipment.

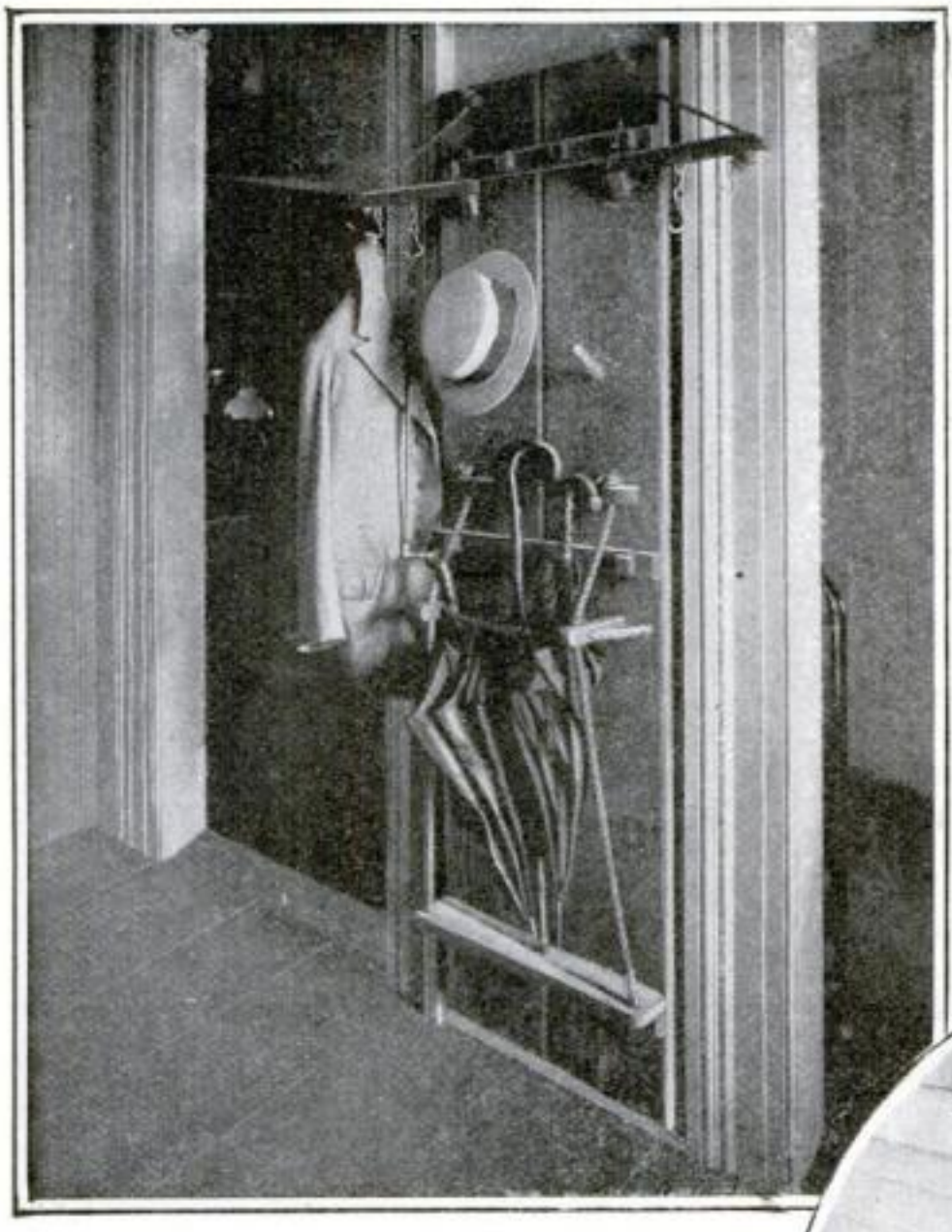
A Handy Magazine-Shelf

A CORNER arrangement for magazines in the form of swinging shelves, obviates the necessity of mutilating the walls by the use of brackets and nails. The boards are joined in the corners by means of cleats underneath, helping to add to the stability of the shelves. The lower shelf is wider than the upper, affording a place for magazines of larger size. Three long and three short chains provide support. These are attached to hooks in the shelves, the two side chains finding their anchorage at the highest point of the mantel and a correspondingly high point on the door-frame. The middle one extends to a hook in the ceiling. Short lengths of chain run from their hooks in the lower shelf to the longer chains. A framed Frieze of the Prophets (by Edwin Abbey) extends entirely around the corner.

An Improvised Hall-Tree

IF you have no place to hang your hat, a couple of boards, a few yards of rope and a half-dozen pieces of wood can easily be made to fulfil your needs. Two wide boards, the height of a doorway, are cleated together as a foundation. The upper cleat is used as an anchorage for a pair of wooden arms which are swung at an angle in order that the coat-hooks will not interfere with the

The convenient magazine racks filled an empty corner and ornamented the room



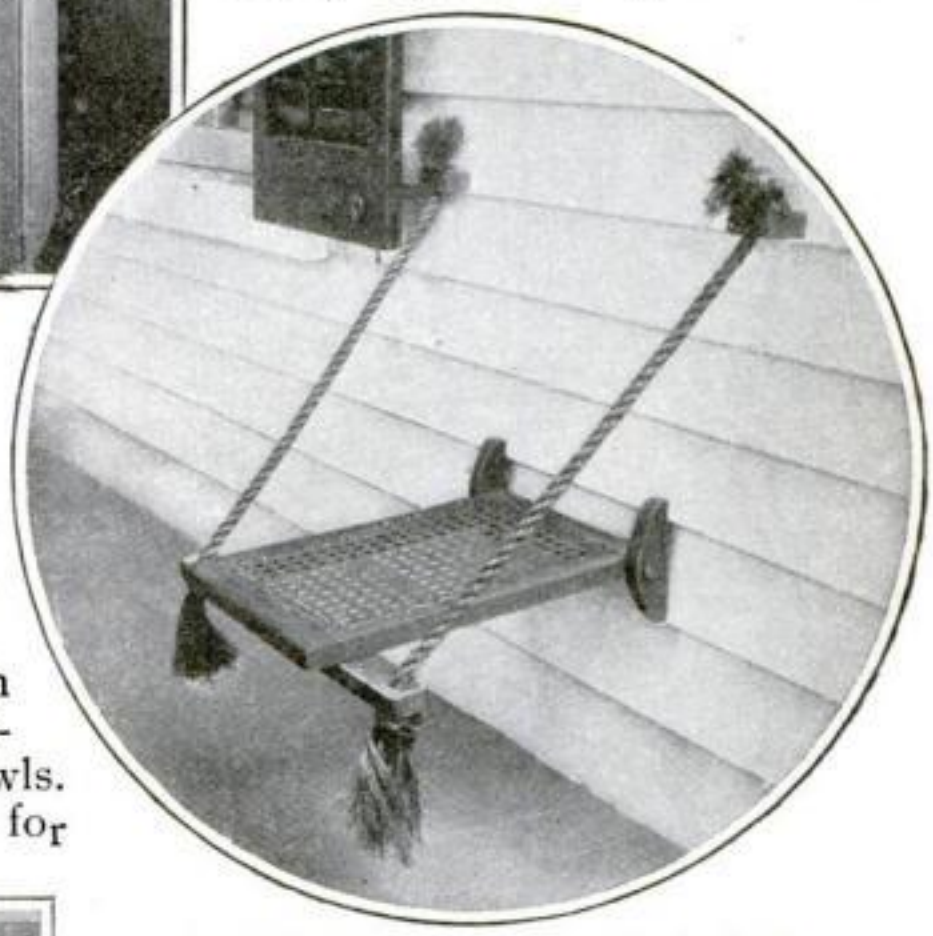
An attractive hall-rack that was made of miscellaneous boards and rope

hats on the pegs below. These "arms" are fitted on wooden pegs that extend through the cleat in such a manner as to permit them to be movable. Heavy wire is bent by pliers to form hooks for the coat-hangers. The hat-pegs are really a pair of wood-handled awls.

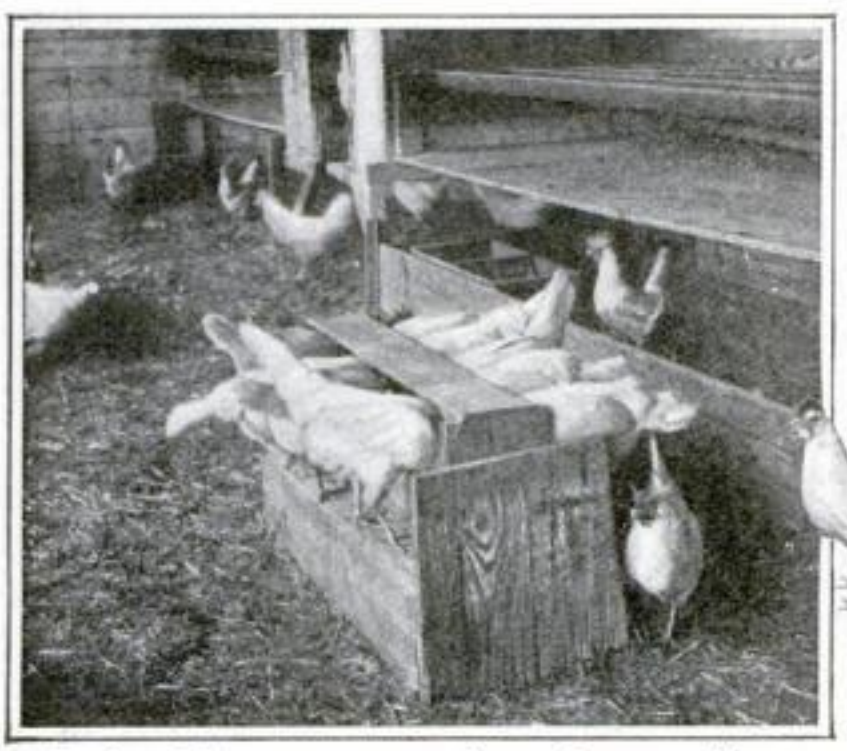
The lower cleat affords support for a six-inch shelf which serves as an umbrella rest. Holes are bored in the outside corners, through which holes the rope supports are passed to the two deep wooden pegs projecting out far enough to receive the umbrellas, and thence to the pair of brackets above the center cleat.

A Nautical Porch Seat

NEARLY every attic has a rickety chair the seat of which might be rescued and converted into a comfortable porch chair such as the one pictured. Attached to a substantial cross-section in front, the back secured to two wooden cleats on the wall, the seat is complete. Two heavy ropes are fringed and knotted through the wooden brackets, then thrust through the holes in the cross-section of the seat.



A porch seat with a nautical air—made from an old chair-seat



Bad table manners gain a hen nothing with this home-made feeding trough

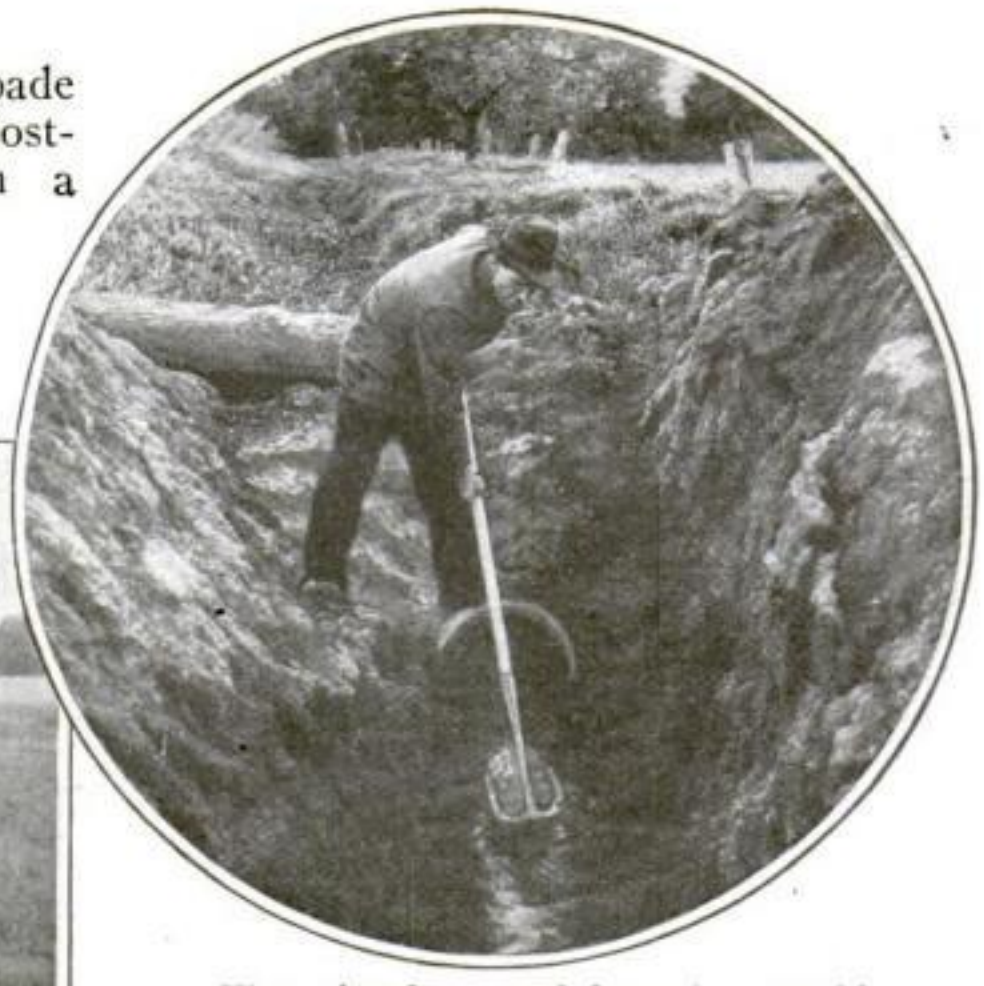
Teaching Hens Good Manners

HERE is a contrivance for correcting the hen's bad table manners. Observe how over-crowding is rendered impossible. The narrow strips of standing-room, and the lack of head-room explain the good behavior. A few packing-boxes and some nails are all that is needed to build this feeding-trough.

Three Tools in One

A RECENT invention is a spade which can be turned into a post-hole digger, ditching-tool, or even a weed-cutter. The tool consists merely of a straight wooden handle, a ferrule, and steel blade like that of an ordinary spade with more

This spade can be used for starting a hole and also for removing the dirt. At an acute angle it is an excellent ditching-tool; at an obtuse angle, a weed-cutting device. Above, the spade as a post-hole digger. Below, as a right-angled hoe



There is often need for a hoe of this size, and it is always a convenience

spade it may be used to start a hole; at right angles for lifting out dirt, or scraping it back; at a small angle it makes an excellent ditching-tool; and at an obtuse angle, with its sharp edge it makes the best of weed-cutting devices.

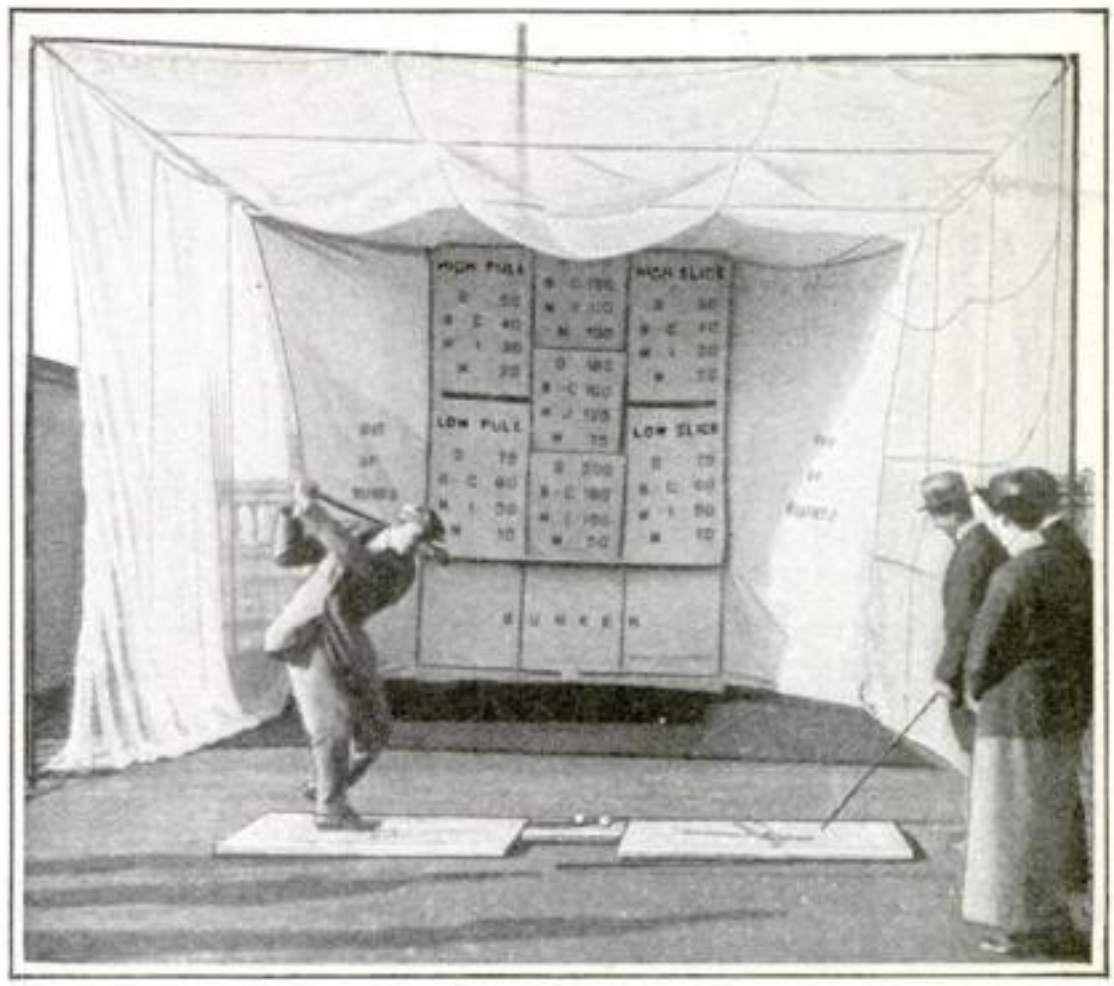
The adjustable device is simple, consisting merely of a case-hardened eye at the upper end of the blade, and having three flat surfaces for the pressure of a spring, placed in the ferrule and pressing upon the eye. At the upper end of the spring the ferrule is pierced by a set-screw which gives tension, thus holding the blade in any one of four positions.

rounding sides, but equipped with a special device by means of which the blade can be brought at right angles to the handle, or at any angle desired. As a

The spade is here shown at its regular work

Playing Golf on the Roof

THE already familiar practice net of the golf stores has been turned to the use of finished players by a Boston hotel. On the roof has been set up the usual sort of net into which the player drives, but instead of the canvas back being merely to stop his ball from flying off the roof, it is painted to show what sort of shot he made. On the right are two sections, "low slice" and "high slice," and on the left two corresponding sections, "low pull" and "high pull." Numbers indicate the distance that would be gained by either, and whether the ball would go out of bounds before stopping. The central panel is dotted with numbers indicating the lenght of drive which would have resulted on a normal course. Wherever the ball strikes, the canvas shows the value of the drive, as to distance and direction. Below the charts is a space two feet high marked "bunker."



Francis Ouimet trying roof-garden golf on the top of a Boston Hotel

Sleep Outdoors in this Hotel

THE fresh-air habit has at last been recognized by a Boston hotel keeper, who, winter or summer, will let you sleep on his roof under a tent, if you have paid for a room down-stairs. Needless to say this hotel is becoming popular.

The roof of a hotel on which patrons may sleep summer or winter

Taking Photographs From a Skyrocket

AMONG the aids to the conduct of the war that have been proposed in Germany is the photography of the enemy's positions by the flight of rockets carrying cameras. The invention is less expensive and can be sent up closer to the enemy without provoking attack than a captive balloon, dirigible or aeroplane. Besides, it is not so dependent upon the wind as a kite.

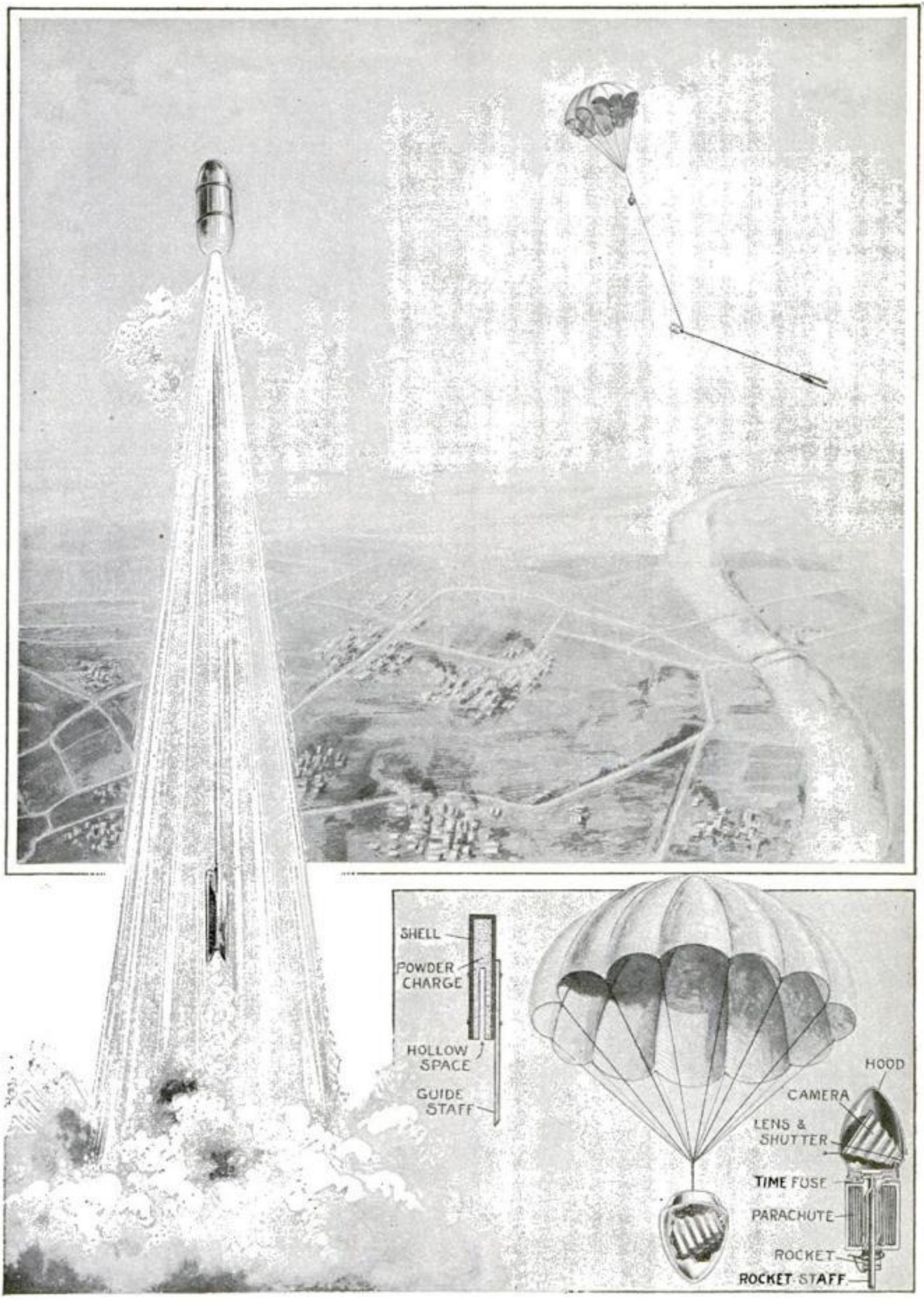
When the inventor, Alfred Maul, began his experiments fifteen years ago, he found, as he tells us in an article appearing in *Umschau*, that the ordinary rocket can hardly carry a considerable weight, and so he was obliged to devise one of greater strength.

His first invention was a shell closed above and open below containing a firmly compressed powder composition in which was a deep opening. Ignition developed a considerable volume of gas, which gas pressed down upon the atmospheric air, thus causing the rocket to rise. In a shot the initial velocity is the highest, whereas in the rocket the initial velocity is low but increases until the charge is burnt out. This occurs in about one and one-half to two and one-half seconds, but the rocket continues to rise, through the force generated, from six to nine seconds.

View of a German town taken with a rocket from a height of 1,550 feet

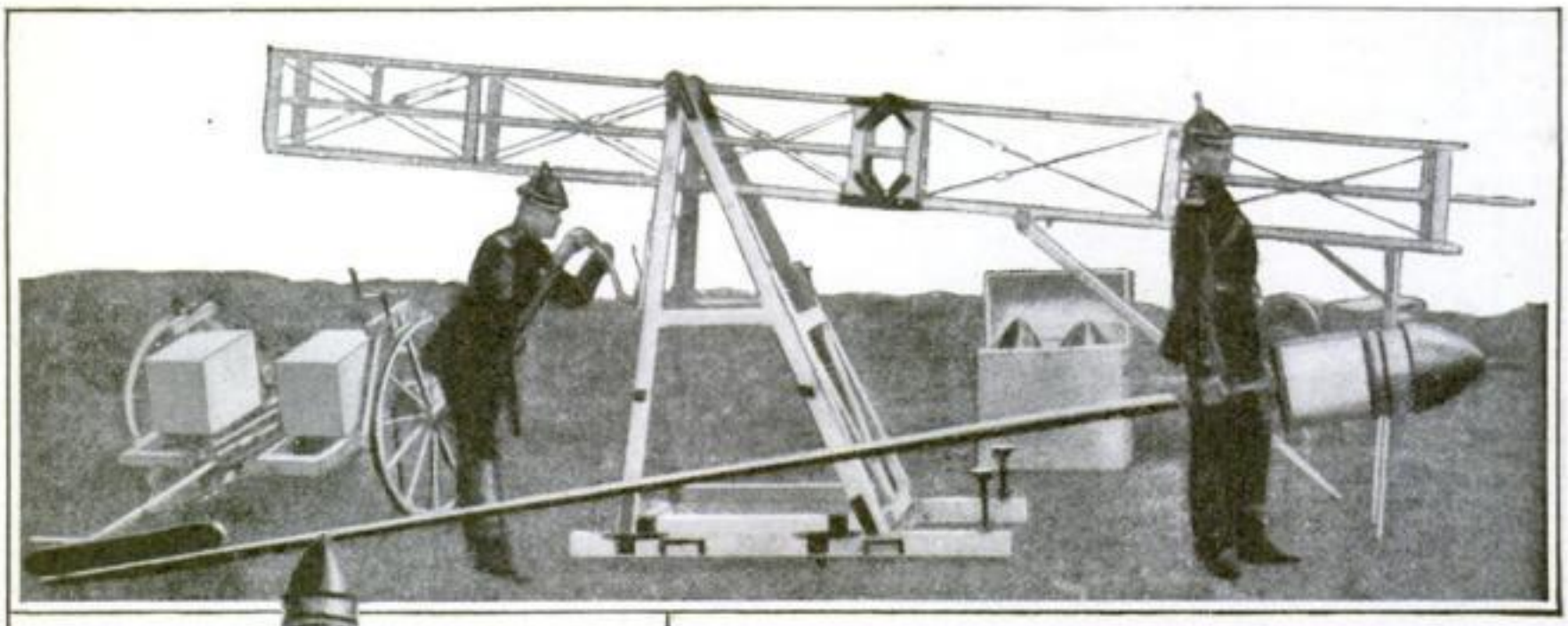
In his first camera experiments Mr. Maul used two small rockets combined. Here the rotary camera, which could take a picture about one and one-half inches square and had an oblique downward inclination, was in a hood above the rockets. At the sides of the rockets were two chambers containing parachutes of unequal size. The guide-staff had two vanes at its lower end, like an arrow, to prevent rotation and change of direction of the lens. At the highest point of the flight a time-fuse raised the shutter and threw out the smaller parachute. Just before landing, the larger parachute was opened. The double rocket could carry a load of over half a pound and rose about one thousand feet.

Failures accompanied successes in the tests. Rockets exploded, parachutes dropped at the wrong moment and much costly apparatus was destroyed, before the inventor saw the cause of his misfortunes, which was that the time taken for ascent depended on the density and moisture of the air. The exposure and release of the parachutes were, therefore, arranged independently of the period of ascent, by making the upper part of the hood resilient and equipping it with an electric contact device. When the rocket paused for a moment at its highest point of ascent, the contact opened the shutter and directly afterward threw out the first parachute. This proving successful, the photographic apparatus was enlarged to a diameter of eight and one-half inches; the plates were made four and three-quarters by four and three-quarters inches, the focal distance was also four and three-quarters inches. The length of the equipment was now over thirteen feet and the weight thirteen pounds. As the apparatus was still inclined to rotate on its axis corrective experiments were made, but the rocket proved unable to carry the weight of a special governing apparatus. Finally, a gyroscopic device was arranged which works automatically when the rocket

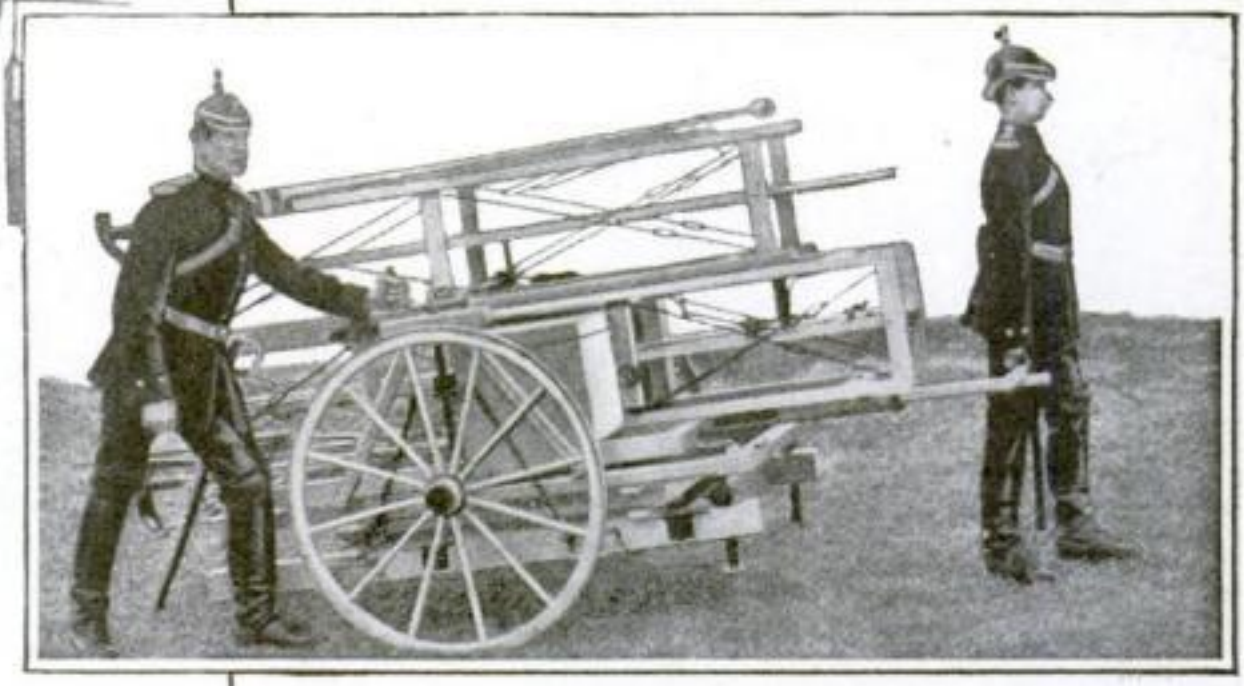


How the Skyrocket Camera Works

Ignited by an electric device, the rocket darts upward sixteen hundred feet. An electric contact opens the camera shutter and releases the parachute which returns the camera in safety



The apparatus needed to fire the skyrocket camera. Above, a view just as the rocket is about to be put in place. At the left, ready to be shot. Below, packed and ready to move away



rises and does not permit rotation.

The present apparatus can rise to a height of sixteen hundred feet. Its length is twenty feet, its weight about fifty-five pounds, and the pictures are seven and one-quarter inches square. Its parts are shown on the preceding page. The guide-staff about fifteen feet long is made in two united but easily separable parts, the upper being bolted to the rocket, the lower carrying the vanes, as shown.

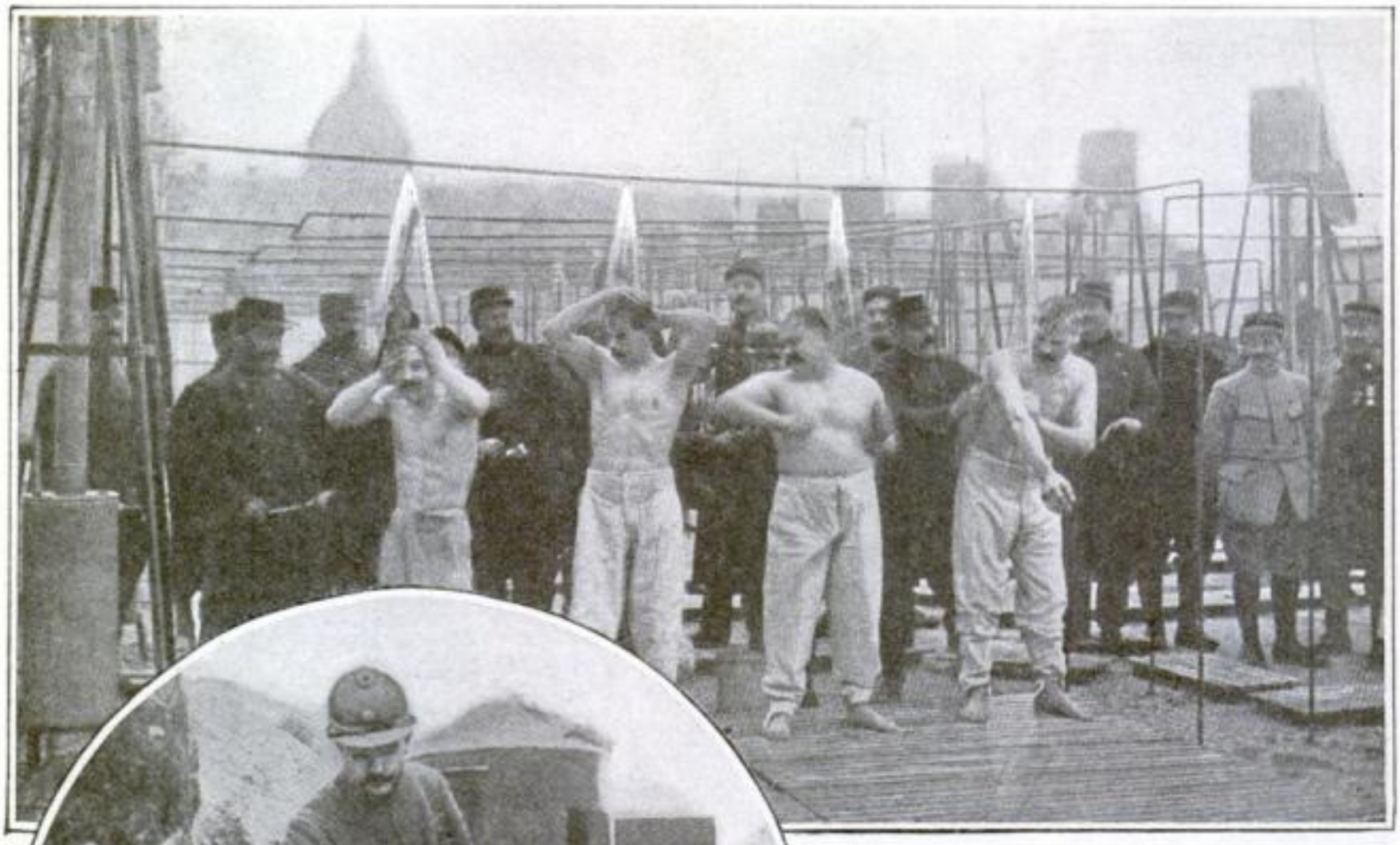
When ready for use the rocket is mounted on a collapsible, heavy frame carrying the sighting device and weighing about eight hundred and eighty pounds. The rocket is ignited by a distant electric device. The weight immediately runs down and the charge is fired, driving the rocket up one thousand, six hundred feet in eight seconds. When near the highest point of ascent the contact in the top of the hood opens the instantaneous shutter and releases the parachute. As the parachute opens, the rocket divides into two parts, connected by a thirty-two-foot belt. The hood and camera hang just under the parachute, while the container and staff swing about thirty-two feet below. The parachute, relieved of extra weight, lands the camera without jar in sixty seconds.

The Mascots of the Troops

The French Military dogs are being put to more and more efficient work during the war. They are now being trained to mount the French parapets and give warning of the approach of the enemy. Here one is being trained

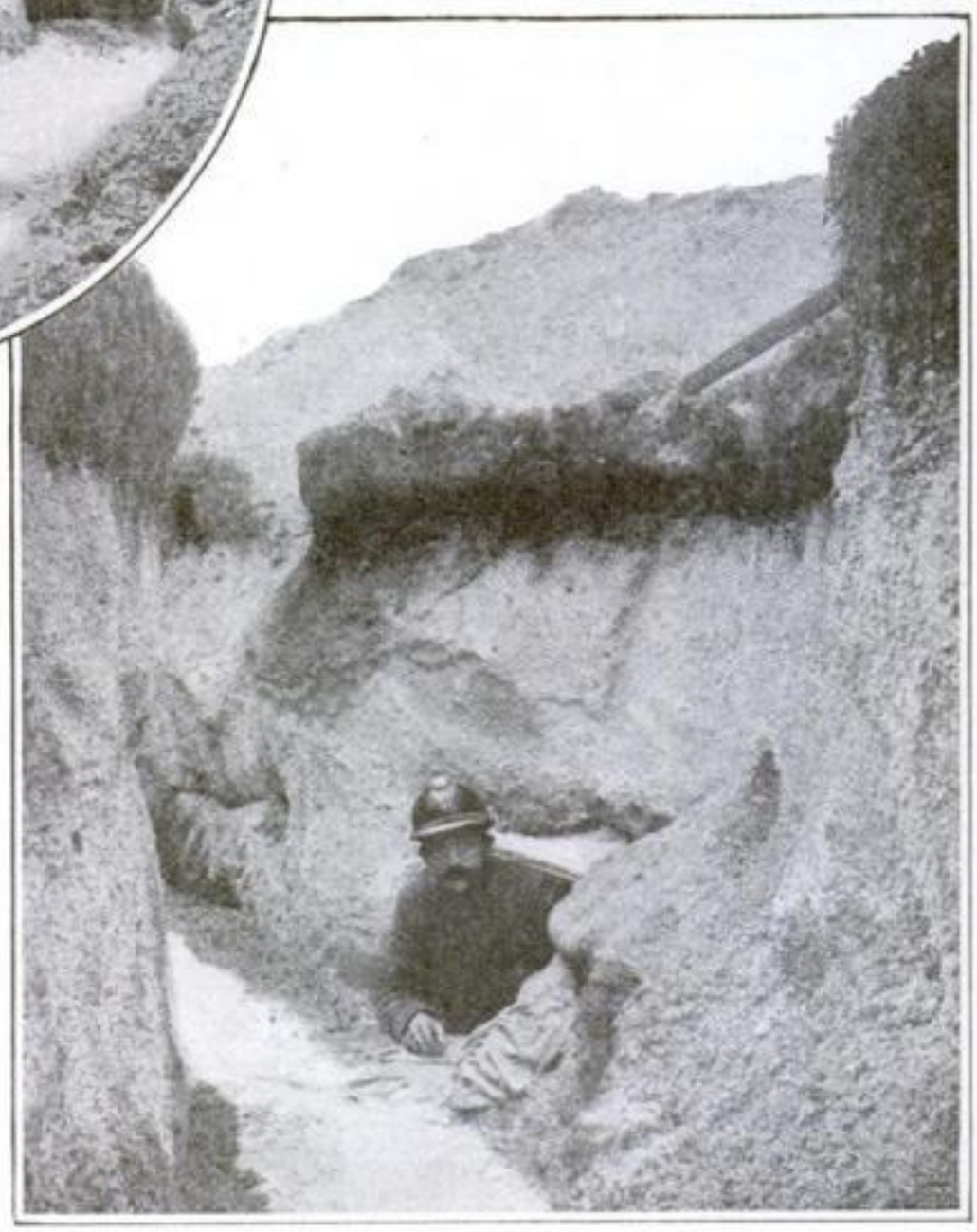
The British soldier who put the respirator-mask over the company's pet pig had a sense of humor. At the wheel of the launch is a mascot of British soldiers in Kamerun, the former German West African Colony. If mascots could bring good luck, every regiment and crew in the world would prosper, for each has its pet

Fighting Mud in the Trenches



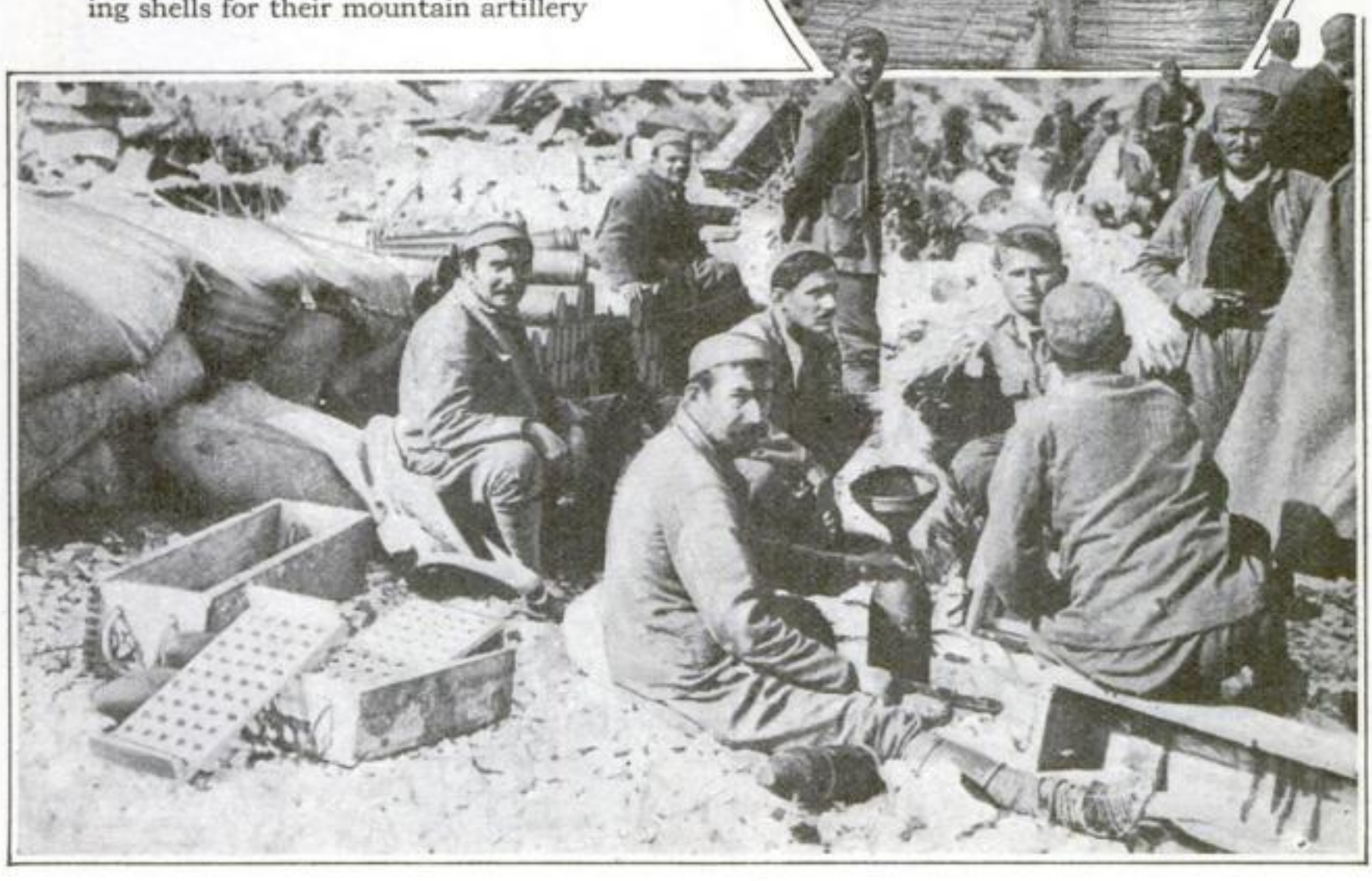
A large number of men can experience the luxury of a hot shower-bath by means of the arrangement shown above. The water passes through a heating apparatus before it reaches the spraying attachments

It is not easy to imagine men standing in trenches like this for three days and nights at a stretch, but that is what they did all through the long winter. Mud inundates the trenches on warm days and freezes in the cold weather. Long rubber boots, called "trench boots," were supplied to the men last winter and relieved the suffering to a great extent. Work in the trenches is not even confined to standing in the mud and fighting. In the illustration at the right is shown a sapper looking out from an air-hole. Many miles of tunneling have to be dug in order to gain desired positions and avoid the fire of the enemy. Underground mining, the digging of new trenches and building huts and caves for residence, give the soldier mud baths from head to foot



The Structural Side of War

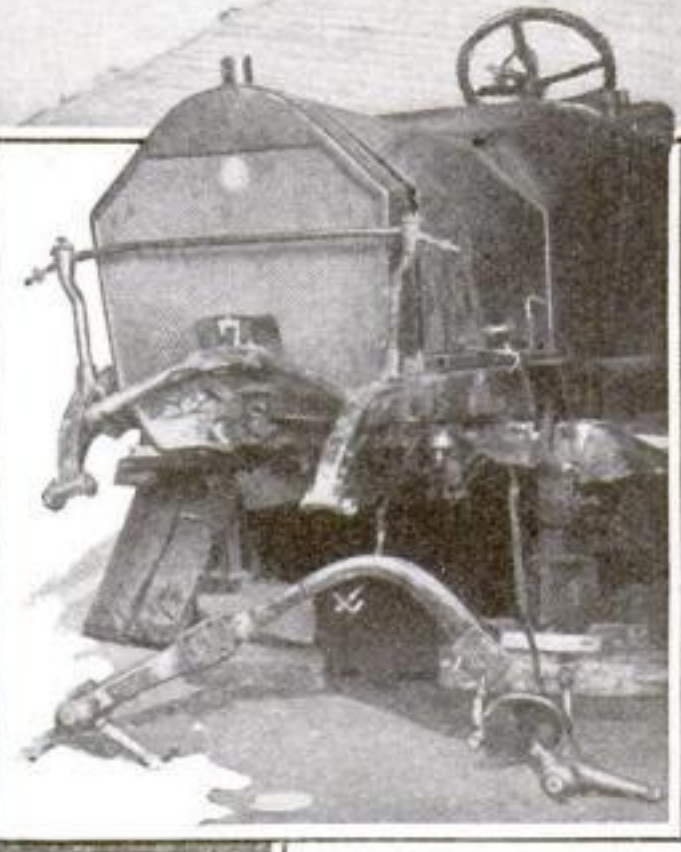
The Austrian soldiers above are stringing a telephone wire in the mountainous Isonzo district. In modern war, every part of an army must be connected with other parts and with the general staff by telephone. At the right, a model German trench and officers' shelter. The sticks prevent the earth from sliding in, and keep the floor dry. Below, Montenegrins are filling shells for their mountain artillery



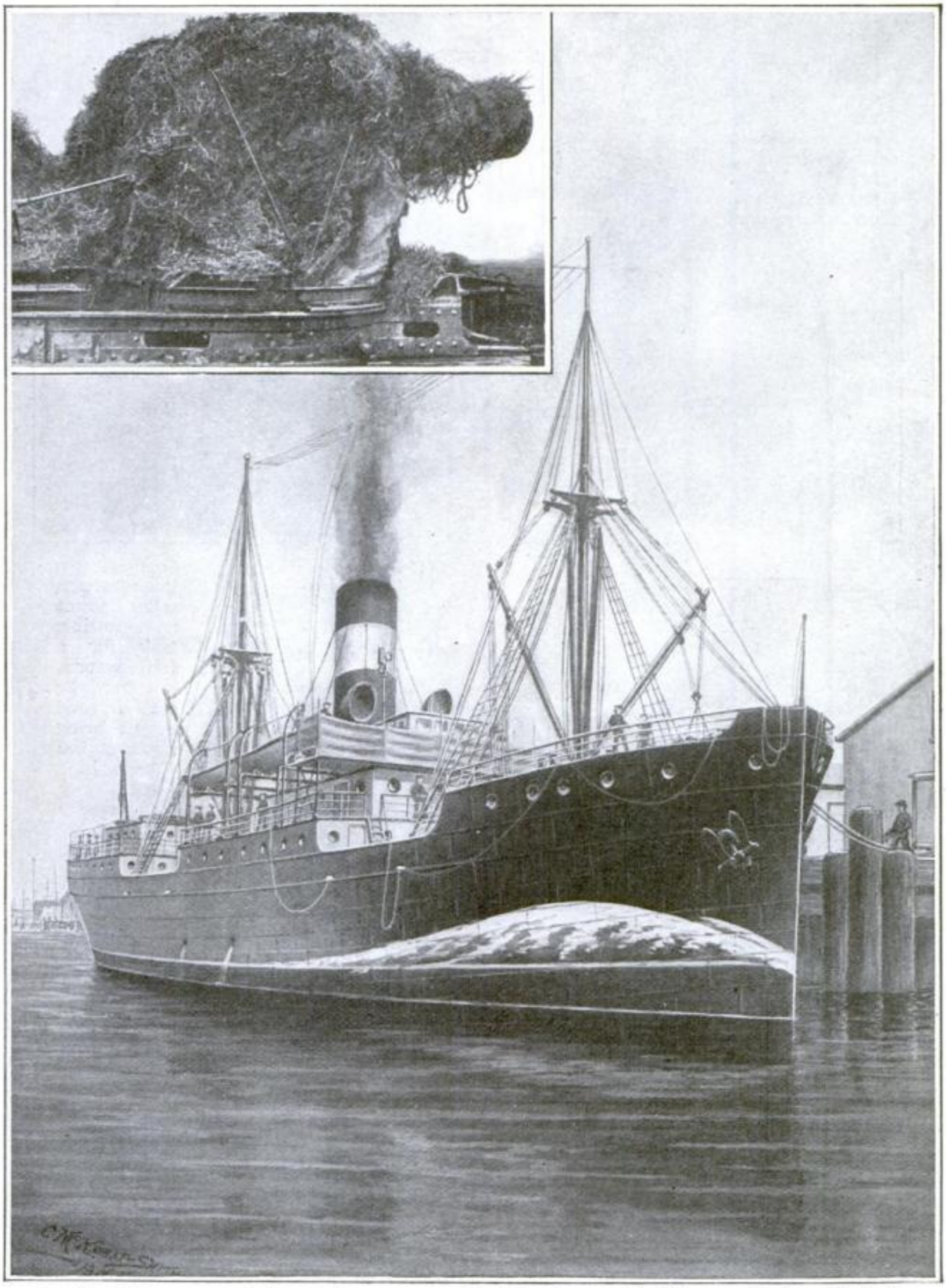
Modern Machinery Resists Even War's Destruction

A German transport column removing the remains of a Russian aeroplane which was brought down by anti-aircraft guns near Lotzen. Although the aeroplane itself was irreparably damaged, the engine was again set up, this time on a German machine

Proof of the excellent quality of the material used in American automobiles was shown when a shell struck the front of an American motor car. Despite the enormous strain which axle and frame underwent, both being bent almost beyond recognition, there was not a crack in the metal



A Russian machine-gun, captured by the Germans during the summer drive, now serves as an anti-aircraft gun to keep Allied aeroplanes away from the town of Tirlancourt, France, which is now occupied by the invading troops. This type of gun is highly prized by both sides



A submarine commander has but one means of judging the speed of the vessel to be attacked —by noting the size of the bow-wave thrown up by the intended victim. The correctness of the estimate means either a hit or a miss. The British have devised a clever method of confusing the German submarines. A huge bow-wave is painted on the sides of the ship, rendering it extremely difficult for the underwater craft to judge the speed accurately. In the insert is shown a heavy Austrian Skeda howitzer concealed with hay to make it invisible to the Russian air-scouts

English Women Doing their "Bit"

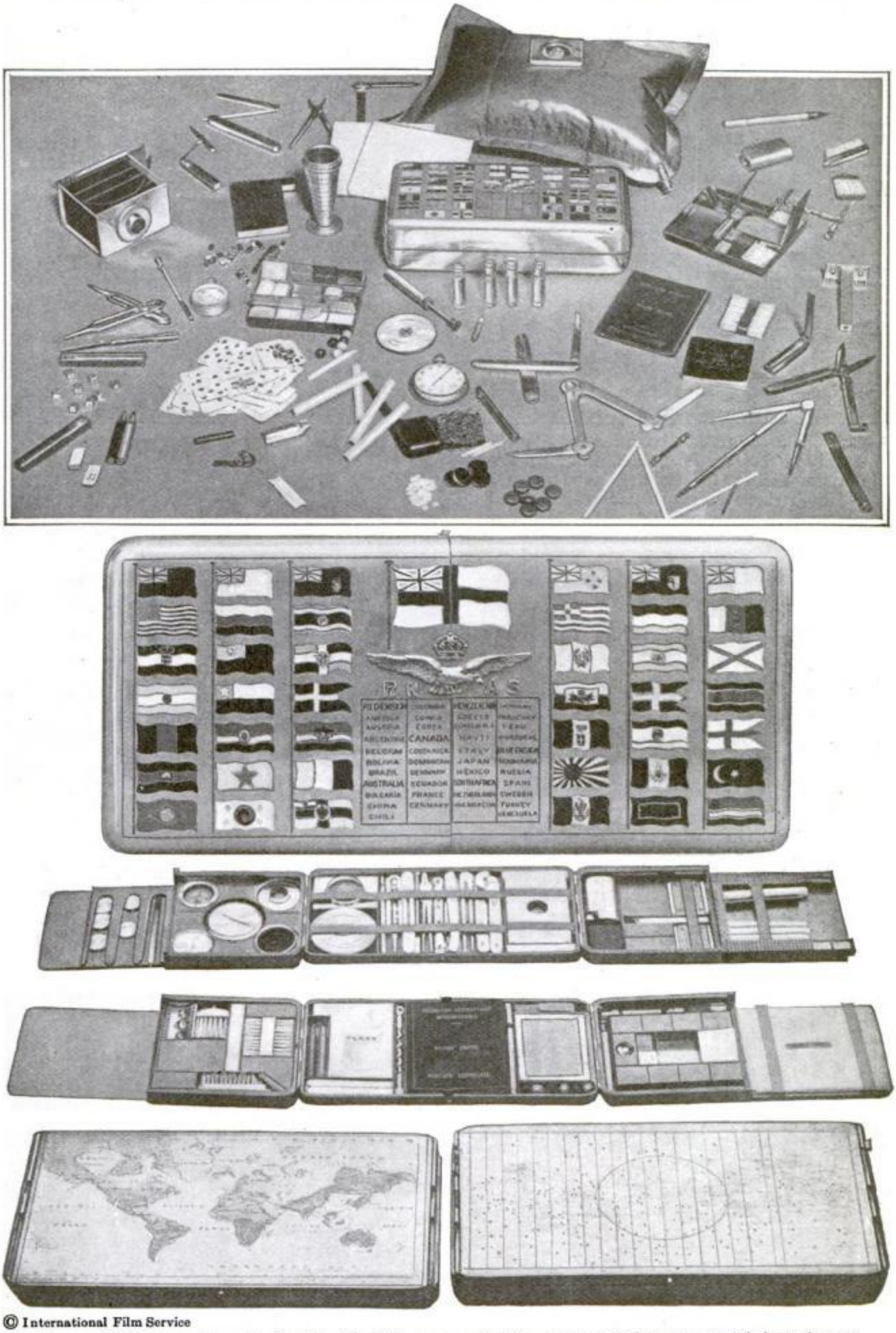
In the circle is a girl who is doing her part as a bricklayer. She does only the tasks that require no skilled labor; but that fact does not lessen the manual exertion required

Another girl who is helping to keep the roads in repair in the country. The heavy work is done by men, but the girl may do much by merely filling up the many worn spots with crushed rock

Operating a large steam roller seems an impossible task for a frail woman, but here we see a road engine being manipulated by a girl

A modern ferrywoman. Among the men's tasks assumed by the British women is that of operating a row-boat ferry across a tidal river

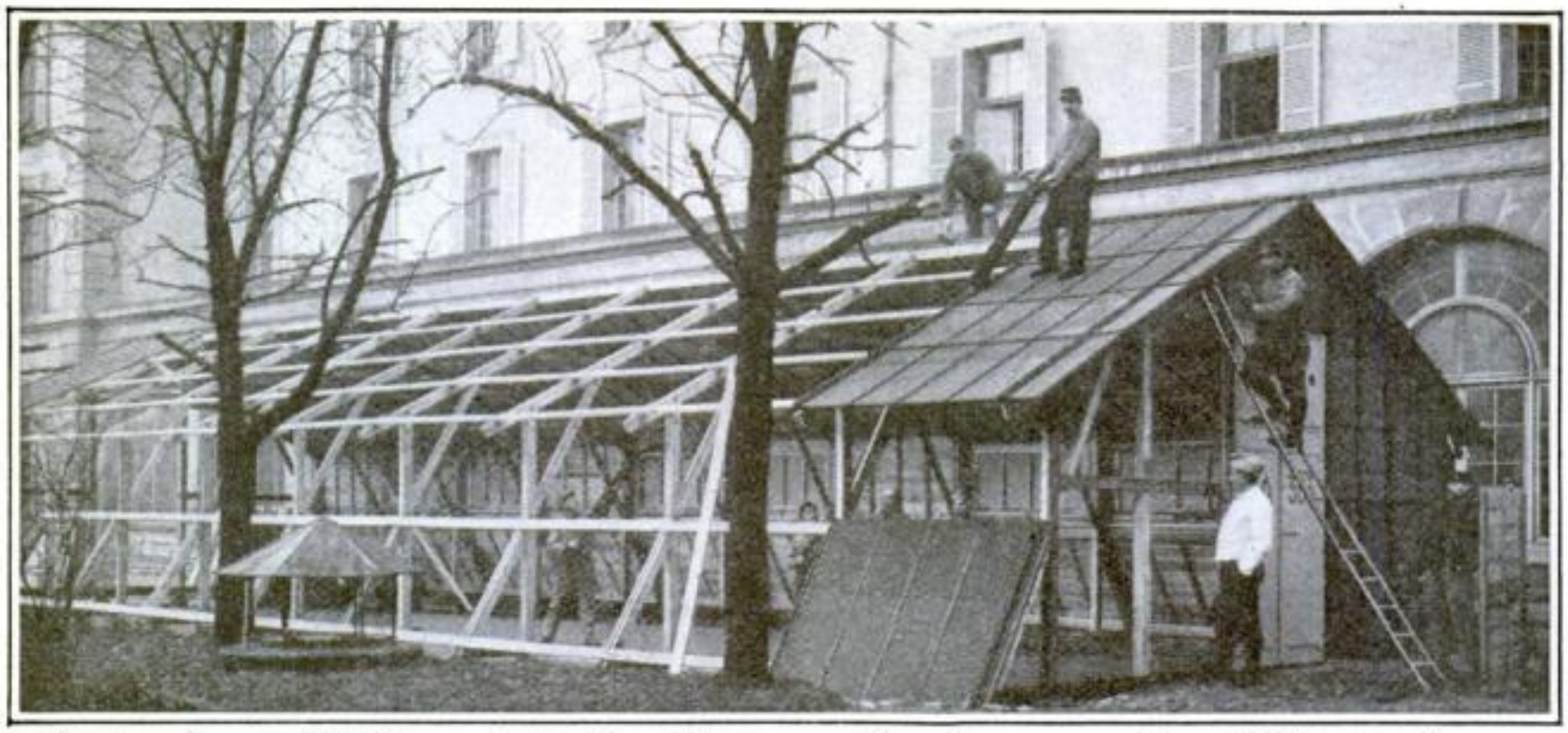
All the Comforts of Home in an Airman's Kit Case



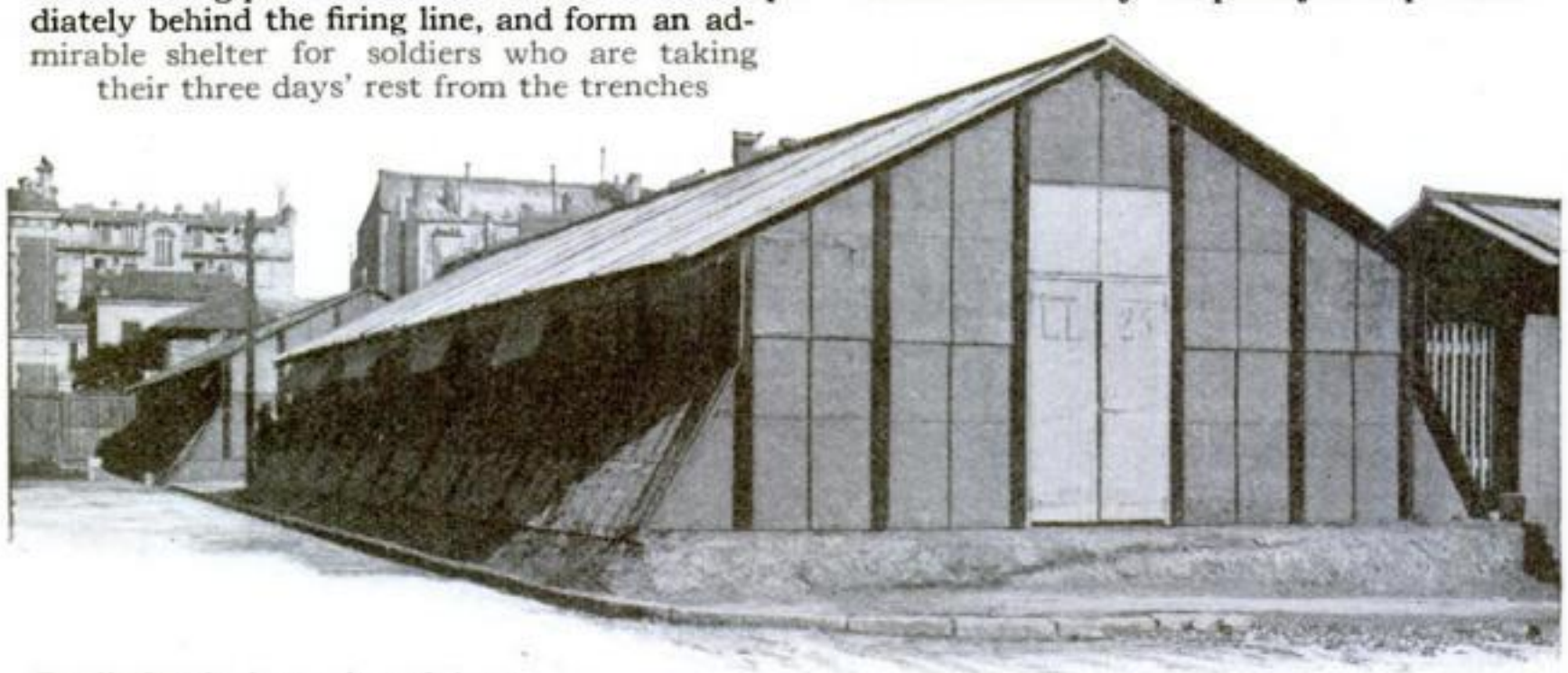
© International Film Service

Every British aviator is furnished with a remarkably compact kit-case containing almost everything which can add to his comfort, from a pneumatic pillow to a pack of cards

Movable Barracks for the French



Constructing portable barracks for French troops. These houses may be quickly set up immediately behind the firing line, and form an admirable shelter for soldiers who are taking their three days' rest from the trenches



Credit for the invention of these portable houses is given to the commandant Adrian, who invented the helmets now used by the French troops, but these barracks resemble very closely the portable houses which are so familiar to all Americans

Making the Deadly Trench Torpedoes

The caps which cover the ends of the torpedoes of large caliber are heated at the forge as shown above, and then welded to the body of the projectile

A completed trench torpedo and its parts before assembling

When they are finished, the projectiles are carefully tested with delicate instruments to verify the sizes and alinements. These clumsy looking bombs are thrown with amazing accuracy

The Paris Zeppelin Raids

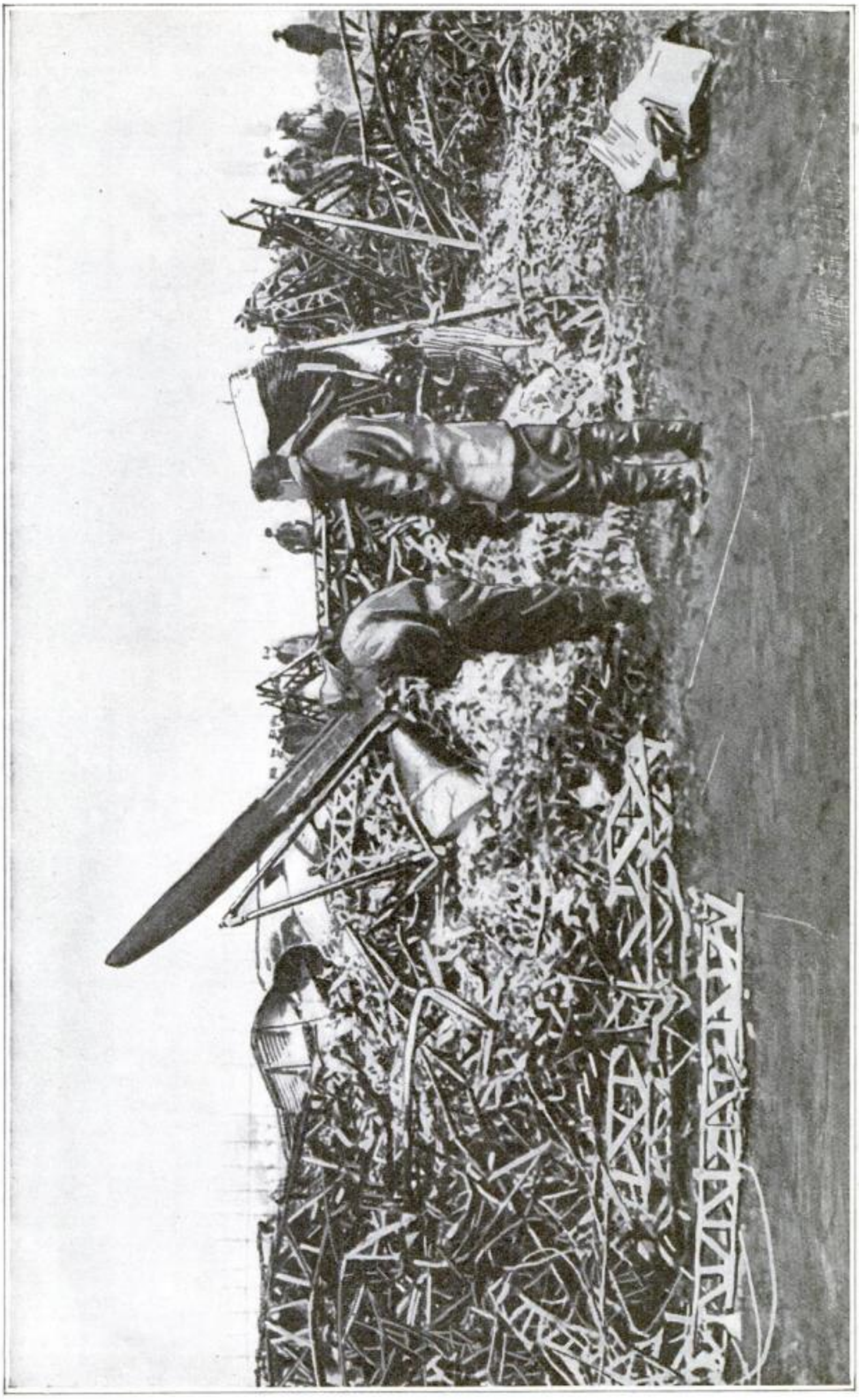
On Jan. 30-31, Zeppelins raided Paris, demolishing tenements and blowing a hole in the subway. Reports showed little loss of life

An unexploded 120-lb. bomb found in a house

An incendiary bomb found after the raid

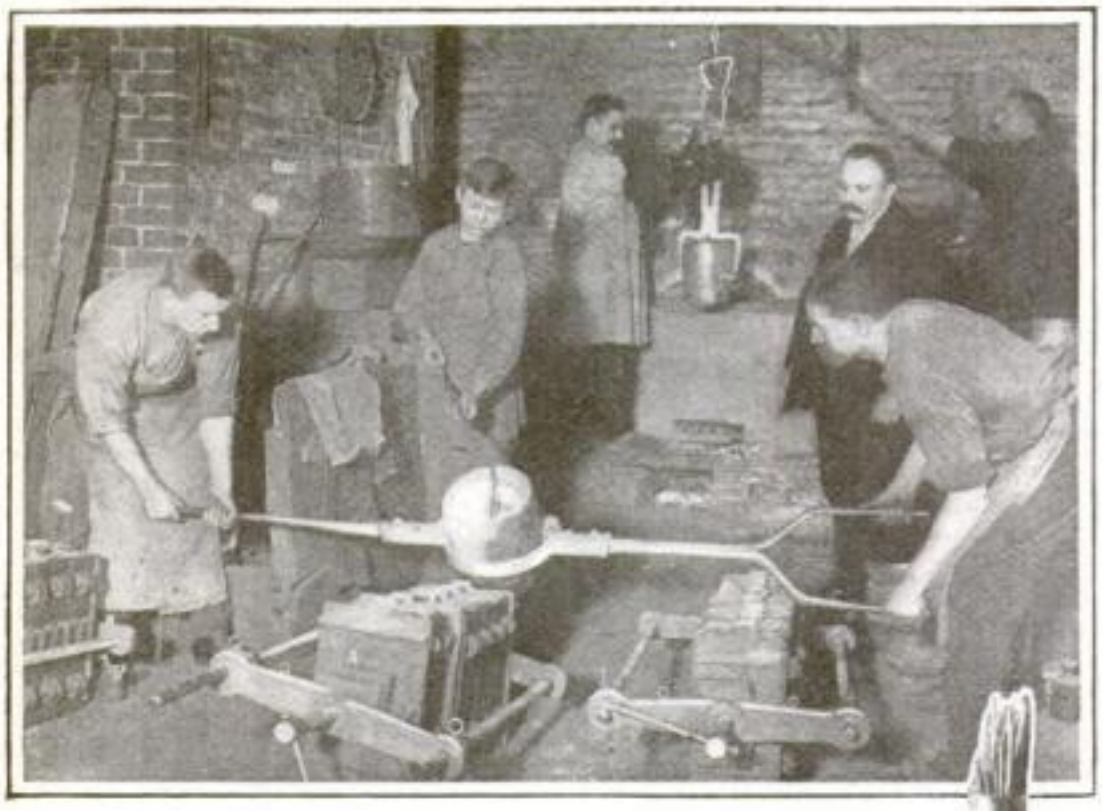
Below, a German soldier resting in a French shell which had failed to explode

The Finish of a Zeppelin



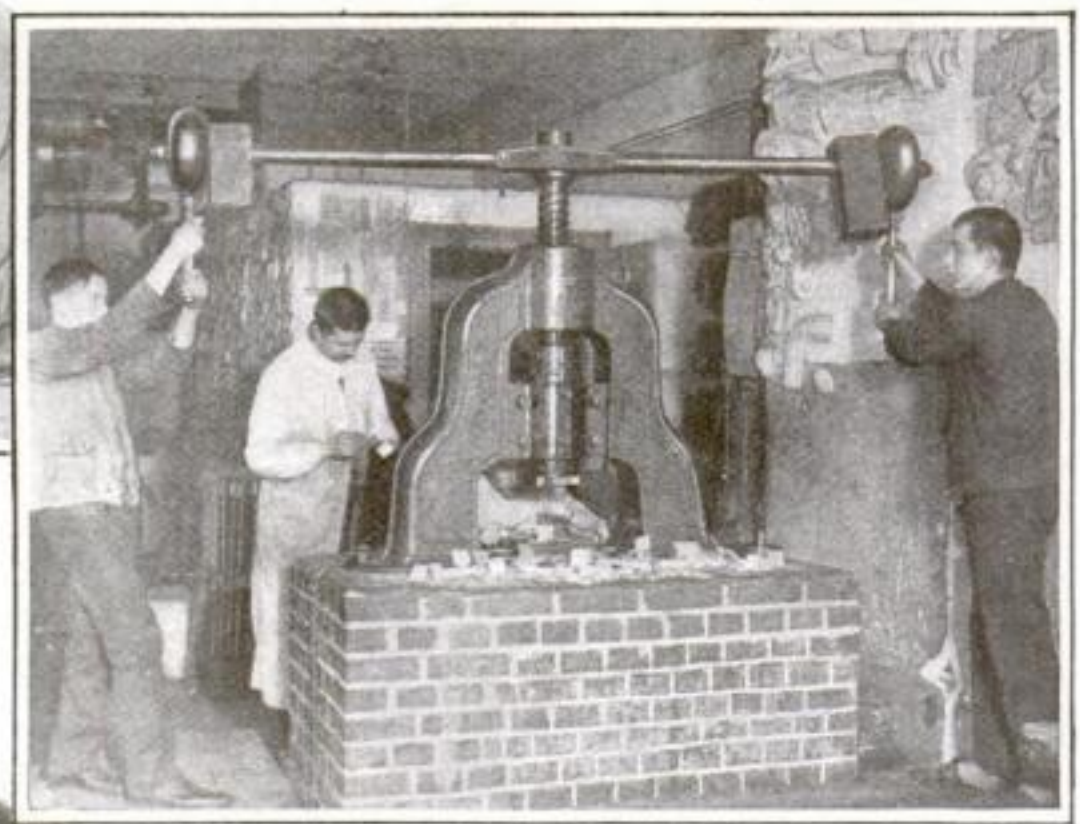
The wreck of the "L-77," the first Zeppelin brought down by gunfire. The airship was working above Revigny, near Bar-le-Duc, and was fired at and brought down at Brabant-le-Roi. Several important changes in design were revealed when the wreck was examined

The Booming Iron-Cross Industry



Every German soldier cherishes the hope that he may sometime win the Iron Cross. The generous bestowals of this reward have resulted in a distinct industry. The crosses are cast in multiple molds, in which the basic form of the cross is formed and the "W" with the imperial crown above and the date below is cast

At the right, the first step in finishing, where the engraver cuts the rough edges from the castings



The effect of the cross is greatly enhanced by a silver thread imprinted in the rim, and resembling a cord

The outline of the cross is stamped on squares of thin silver plate by subjecting the plate to great pressure in a screw-press

After the iron center is soldered to the silver rim, the cross is sawed out by hand, preparatory to the final polishing

Gas Is No Respecter of Persons

An infernal machine of the trenches. This small cylinder, when filled with the proper chemicals, will manufacture enough asphyxiating gas to kill hundreds of men. It is one of the many which are used by the Austrians in overcoming the enemy's forces before an attack

The children of towns on the firing line may meet gas at any moment on their way through the streets. Here are seen school children of Rheims lined up for the inspection of their gas helmets. So many gas attacks are launched in the immediate neighborhood of this unfortunate French city that no one is safe in the streets without a gas mask ready for immediate use. The school children are required by their teachers to carry a helmet, and if upon inspection the masks are found faulty or missing, the offending pupils are punished. Below is a French mother adjusting her daughter's gas mask before she leaves the home

Villa, the International Outlaw

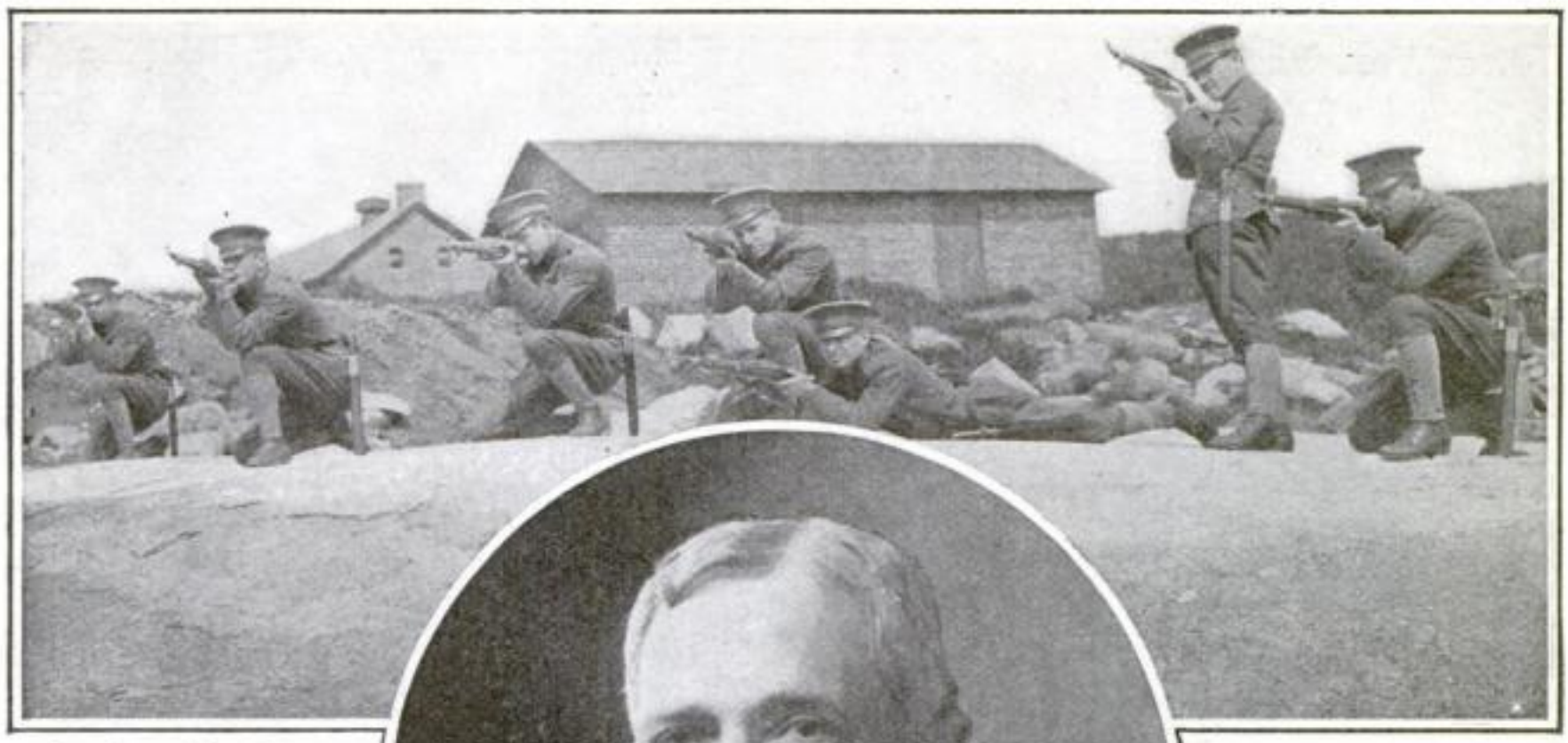
At right, Francisco Villa, who was once a Mexican presidential possibility

Above, a typical Mexican "army"—poorly clothed, but well armed and thoroughly seasoned veterans, and equally at home in the mountains or on the desert

The only Mexicans who do not fight—Indians from the Sierra Madres. Most Mexicans are born outlaws, who see no reason why they should work when they can live by outlawry

American soldiers guarding food destined for Mexican refugees

And His American Pursuers



American soldiers on the Rio Grande—the type of boys who are out after Villa. The American regular army, man for man, is as fine a set of soldiers as fight under any flag

At the right, Gen. J. J. Pershing, leading the American Army which had orders to get Villa "dead or alive." His instructions were those General Funston received regarding Aguinaldo—and he is doing his work in the same thorough way

The wig-wag man is an indispensible member of the expedition

The signal corps, on whose field instruments the army will depend for communication. Below, a portion of the Thirteenth Cavalry on the march

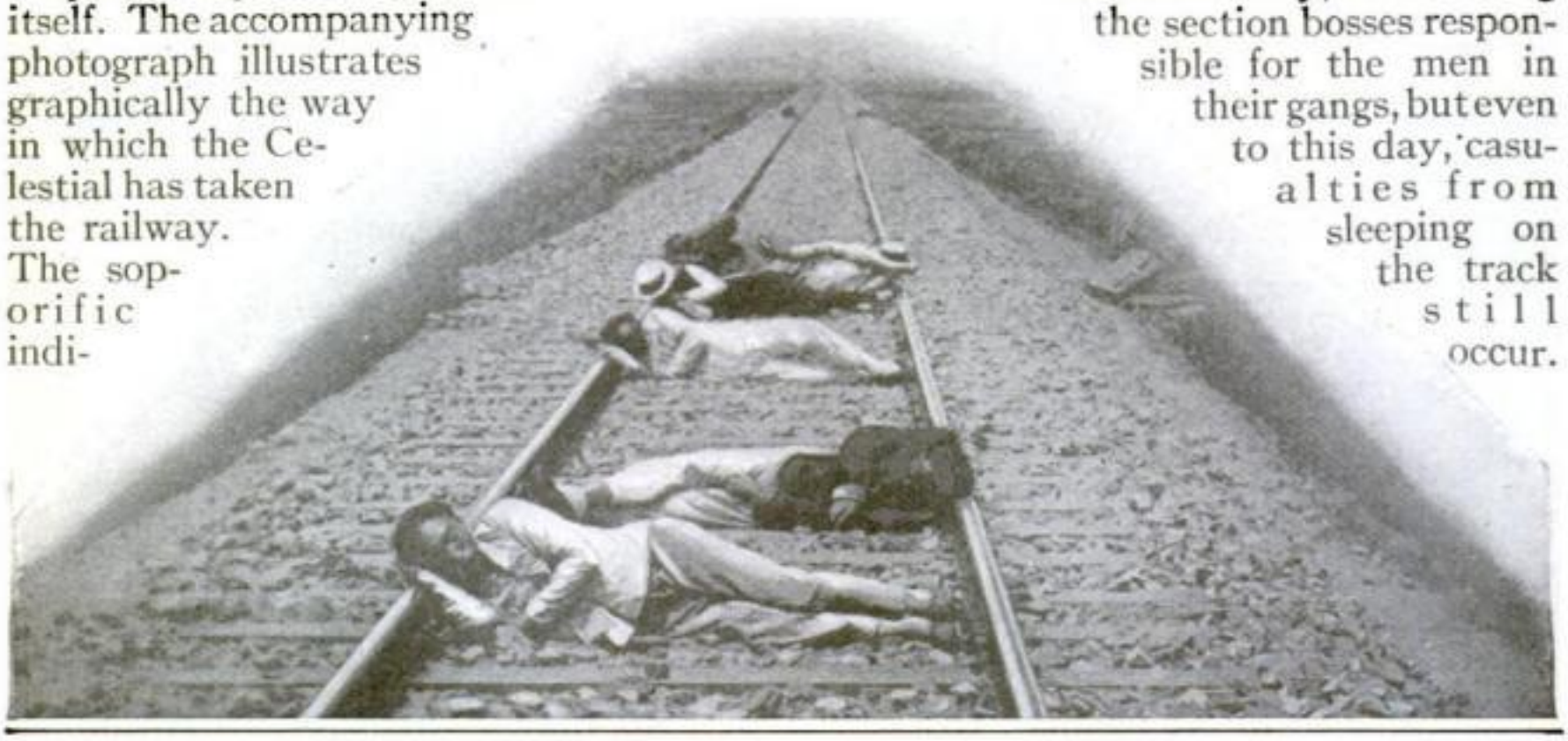
One Tree Grows Through Another

IN a West Virginia forest nature has played an unusual prank upon two trees. One of them is a maple and the other an oak. Close inspection reveals the interesting fact that the oak tree has beyond doubt grown up through the maple. The oak being the more rugged of the two trees is causing the maple where its bifurcated trunk joins, a few feet above the ground, to split.

An oak tree growing through a maple

Asleep On the Sleepers

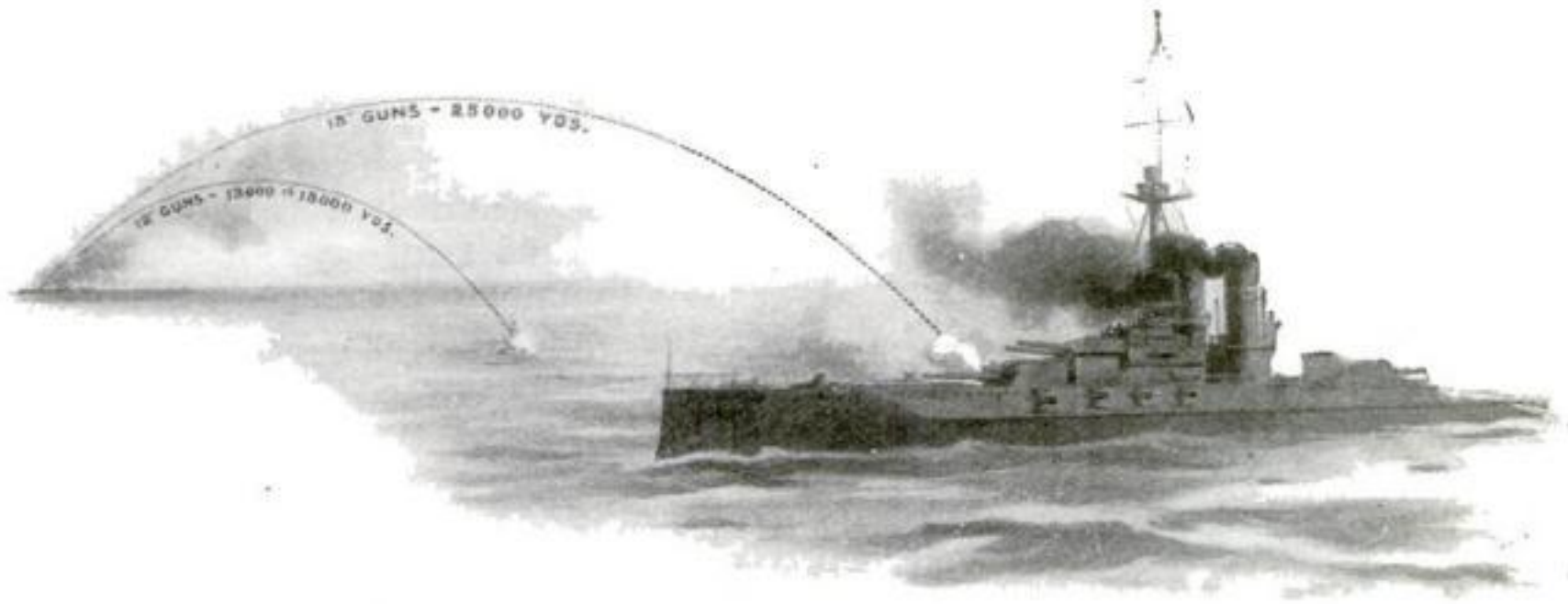
WHEN the first railways were built in China it was necessary, first to force the coolies to work upon them at the point of the bayonet, and later, to protect these coolies by force of arms from the outraged inhabitants of the countryside through which the railways ran. This feeling passed rapidly, however, as the Chinaman's philosophical disposition asserted itself. The accompanying photograph illustrates graphically the way in which the Celestial has taken the railway. The soporific individuals are section hands on the Shanghai-Nanking Railway, and because the little wooden pillows on which they and their ancestors have been resting their heads for a good many thousands of years were almost exactly similar—both in height, cross-section and hardness—to the eighty-pound "T" along which they were working, they were not long in adapting the convenient metals to the same purpose. There is one swift express which speeds over the straight and well-ballasted track between Shanghai and Nanking at the rate of sixty miles an hour, and in the first days that the "noonday sleep" habit became popular it was no uncommon thing to have two or three decapitated coolies reported at headquarters every evening. This finally became so troublesome that orders were sent out prohibiting the practice absolutely, and holding the section bosses responsible for the men in their gangs, but even to this day, casualties from sleeping on the track still occur.



The Chinaman's pillow is a hard wooden bench, the size and shape of rails. So why shouldn't the coolies use these nice pillows the railroad laid down

Helpless United States

By Frederic Louis Huidekoper



The range of United States coast artillery as compared with that of guns mounted on British dreadnoughts of the "Queen Elizabeth" type

Although Mr. Huidekoper is not a professional soldier, he is an earnest and close student of military history, whose writings, notably his "Military Studies," have been consulted with profit even by staff officers. The following article is abstracted from his book, "The Military Unpreparedness of the United States," by permission of Messrs. Macmillan and Co., the publishers.—EDITOR.

ACCORDING to the latest statistics available, dated April 20, 1915, the authorized strength of the Regular Army—was 4,833 officers and 87,877 enlisted men, while that of the Philippine Scouts was 182 officers and 5,733 men, thus making a total of 5,015 officers and 93,610 men.

Notwithstanding the small size of the Regular forces in continental United States, the policy of the War Department to maintain the overseas garrisons at full war strength—a very sound policy since it will be almost impossible to reenforce them for some time after the outbreak of war and then only under the most favorable circumstances—must require a further reduction in them. As the Secretary of War very pertinently pointed out in his report for 1914:

"It will be necessary in the very near future to take from the United States and put into the Philippines thirteen companies of Coast Artillery, 1,950 men; in the Hawaiian Islands, three regiments of Infantry, one battalion of Field Artillery, and two companies of Coast Artillery, 6,380 men; and in the Panama Canal Zone, one regiment of Infantry, one squadron of Cavalry, one battalion of Field Artillery, one company of Engineers, and twelve companies of Coast Artillery, 4,774 men. . . . This will leave in the United States proper 12,610 Coast Artillery troops and 24,602 of the of the mobile army, the latter being then not much more than twice the size of the police force of the city of New York."

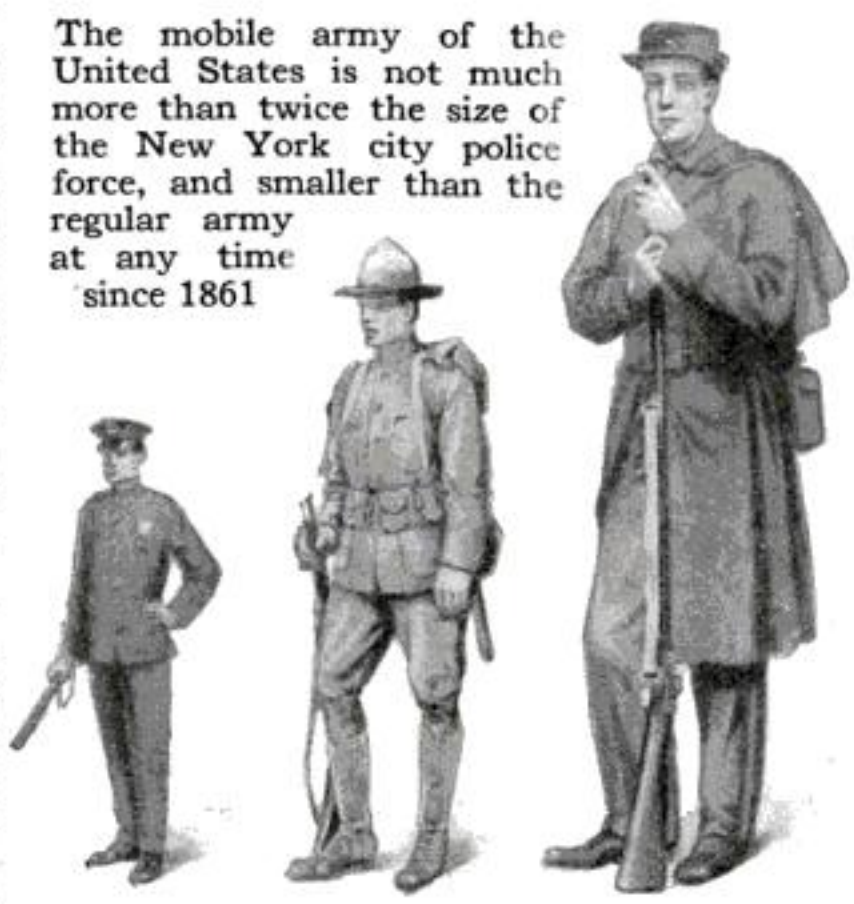
As the Coast Artillery must of necessity remain stationary in fortifications, the only force that can be transferred to repel attacks by an enemy seeking to land or penetrate within our borders is the Mobile Army, which will shortly be reduced to 24,602, as Mr. Garrison has stated.* It is an astounding proof of our unpreparedness at the present moment that such a force would be smaller than the actual strength of the Regular Army at any time since the close of 1861 — save in April, 1865, when it numbered only 22,310, but when we had more than a million volunteers who were Regulars in everything but name—notwithstanding that in those 53 years our population has increased from about 31,000,000 to 100,000,000.

We Have No Modern Howitzers and Not Enough Field Guns

On December 8, 1914, according to the

* Since this passage was written the Mexican situation has mitigated its force. The Mobile Army will be increased, probably permanently.—EDITOR.

testimony of Brigadier General Crozier, the Chief of Ordnance, the United States possessed only 658 three-inch field pieces, and even when the guns under construction and those provided for by the present appropriation have been finished, the number of guns of all calibers will not be more than 912. The minimum estimate of what would be needed has been placed at 323 batteries of four guns each, a total of 1,292 guns, while the maximum estimate, made by the late Chief of Staff, was 2,834, which is undoubtedly what would be required in a war against a great Power. On December 23, 1914, the Secretary of War acknowledged that we had only 634 completed modern field guns and howitzers altogether. The United States has nothing larger in caliber than the 6-inch howitzer, and only forty of those either in existence or appropriated for; yet every one knows that in the present European war great use is being made of heavier guns than these. The Chief of Ordnance also testified that, even when the design has been decided upon and the forgings delivered, the actual construction of a gun requires about four months; that a battery costs about $85,000; that if $2,100,000 were appropriated annually it would still require eight years before the United States would have 1,292 guns.



The mobile army of the United States is not much more than twice the size of the New York city police force, and smaller than the regular army at any time since 1861

In no other respects is the military unpreparedness of the United States so apparent as in the matter of reserve artillery ammunition. The minimum number of rounds per gun required in the German Army is 2,800, while our own Field Service Regulations for 1914 prescribe 1,856 rounds. Disregarding the other field pieces possessed by the American Army and assuming that the 568 three-inch guns were alone supplied with 1,856 rounds each, the number required would be no less than 1,054,208; yet the Chief of Ordnance confessed on December 8, 1914, that all the United States then had "was about 580,000 rounds for the Field Artillery, for the guns of all different calibers." If the 634 field guns of all calibers which the United States possessed in December, 1914, fired only 915 times each, they would more than exhaust the present reserve supply of field artillery ammunition amounting to 580,000 rounds, and it is a conservative estimate that two days of such firing as is a common occurrence in the battles of the present time, would suffice to consume the entire amount now on hand. The Chief of Ordnance stated that even if every source of supply were utilized, only "about 400,000 rounds" could be manufactured in the first six months; that only 130,000 rounds could be turned out each month thereafter; that a million rounds might be made in a year; that we need about a million and a quarter; and that "it takes over a year to get that much if we were to go at it with unlimited appropriations."* General Crozier had to confess that "no permanent ammunition trains have been provided," and that at the present rate of appropriation by Congress it would require eight years to complete 1,292 guns and their ammunition trains, and about four years to supply 1,800 rounds to the field guns of various calibers—with the exception of the 6-inch howitzers to which it was contemplated to give only 1,000 rounds—and then only on condition that the various plants throughout the country were kept "going night and day" in manufacturing artillery ammunition.

Plenty of Rifles, But Too Few Machine-Guns

After considerable experimentation the Ordnance Department has found it ad-

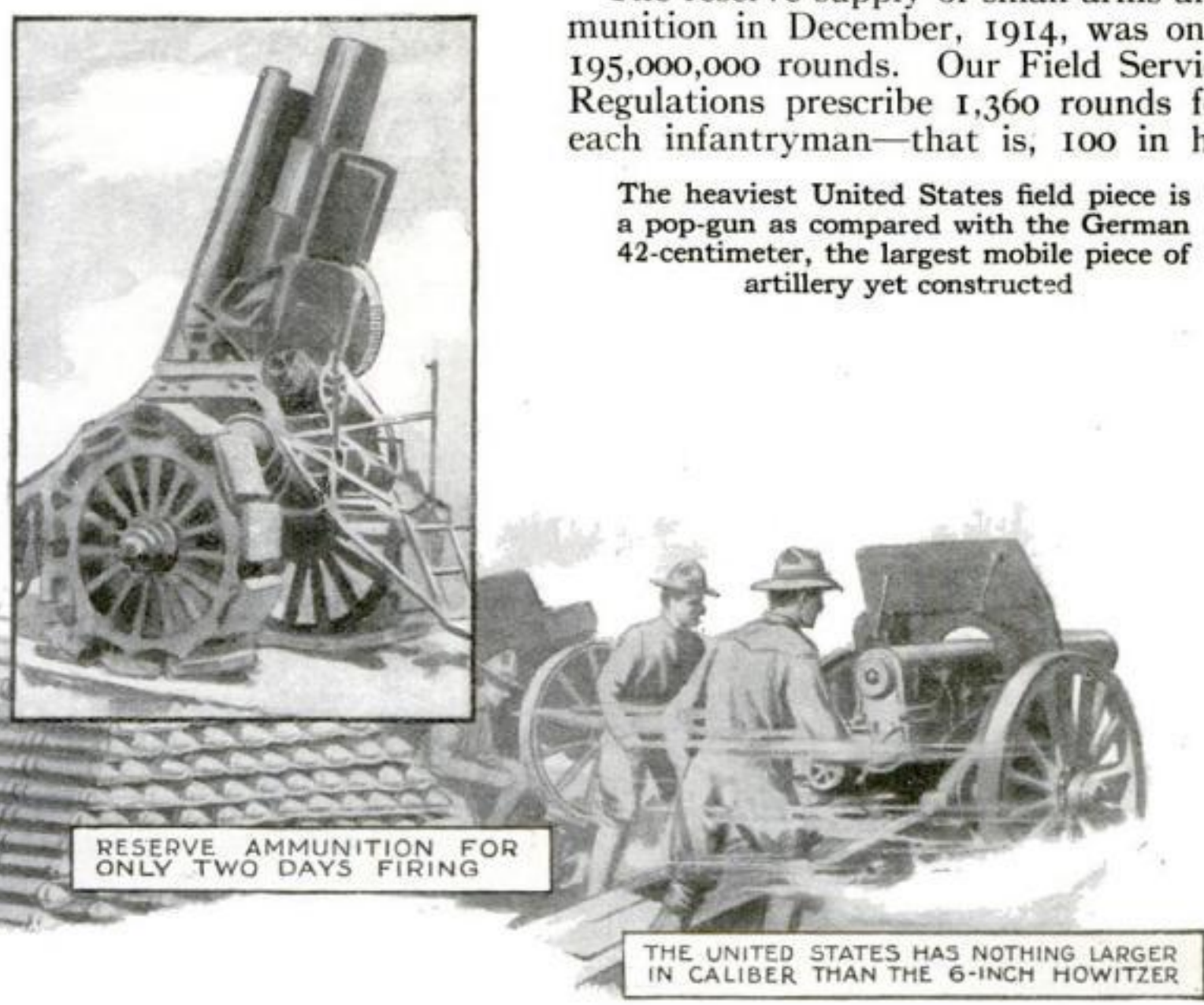
* Many American factories have engaged in the making of munitions for the Allies since this comment was made. We are probably in a better position now to meet our ammunition requirements.—EDITOR.

visable to discontinue the manufacture of the service model of machine-gun and has adopted the gun made by the Vickers Company of London as the better weapon. Of the old model—Gatling and Colt automatic guns—there were 1,380 in December, 1914, but many were obsolete and only 1,000 could be counted upon as serviceable. The former estimate of 1,801 machine-guns required by the Army has within the past year been cut down to 1,361, on the basis of four per regiment. This is manifestly far too low, as the French among others have increased the number of machine-guns per regiment to more than forty during the present war, owing to their great power of destruction. Only 125 machine-guns were manufactured for the American Army during the fiscal year ending June 30, 1914, and the supply of ammunition for them is fixed at 21,400 rounds per gun.

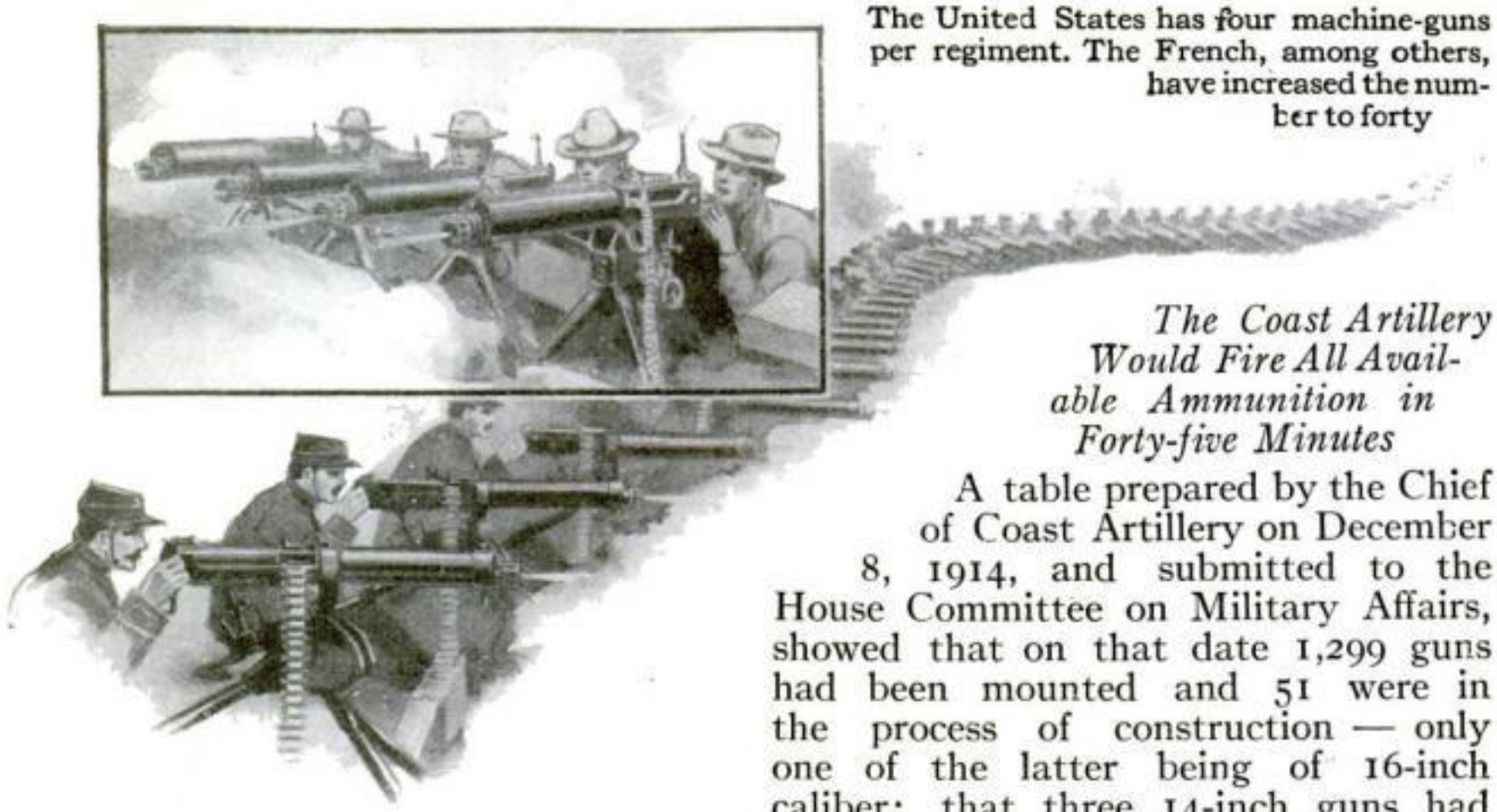
A more satisfactory condition is found in respect to infantry rifles, of which the United States possessed on June 30, 1914, slightly less than 700,000 of the most modern Springfield pattern, as well as between 300,000 and 400,000 of the old Krag-Jörgensen rifles. During the preceding year, 25,545 United States rifles, caliber .30, model of 1903 (or Springfield) were manufactured, which is at the rate of about 82 per working day, whereas that one small-arms factory has a capacity of 500 rifles per diem. The Chief of Ordnance declared that a reserve of 800,000 small-arms was desired, which would be sufficient to arm any force such as the country would be likely to need for the first months of war. It will, however, be necessary to increase the last appropriation—which was only $250,000—if the remaining 100,000 rifles are to be secured within several years.

Only Four Days' Supply of Ammunition For the Infantry

The reserve supply of small-arms ammunition in December, 1914, was only 195,000,000 rounds. Our Field Service Regulations prescribe 1,360 rounds for each infantryman—that is, 100 in his belt, 120 in the combat train which goes with the troops, 120 in the ammunition train which follows behind the supply trains, 340 rounds in the advance depot from which it can be sent forward to the troops, and 680 in the depot at the base of supplies. In other words, 195,000,000 would not be sufficient to supply an army of 145,522 infantrymen with 1,360 rounds each. The 1,360 rounds



The heaviest United States field piece is a pop-gun as compared with the German 42-centimeter, the largest mobile piece of artillery yet constructed



The United States has four machine-guns per regiment. The French, among others, have increased the number to forty

prescribed for American infantrymen would, in all probability, be exhausted in four days' fighting.

The range of guns being one of the most important factors in war, the House of Representatives, by Resolution No. 698, adopted on January 14, 1915, called upon the Secretary of War for information in respect to our seacoast cannon. On the following day Mr. Garrison replied in a communication to the Speaker of the House, in which he stated:

(1) That there were no guns mounted in the fortifications of the United States proper of a caliber larger than 12 inches.

(2) That the range of the 12-inch guns mounted on the standard disappearing carriage was not more than 13,000 yards, but that the range of the 12-inch guns mounted on barbette carriages was approximately 18,000 yards.

(3) That the British dreadnoughts of the *Queen Elizabeth* type were equipped with 15-inch 45-caliber guns, and that their range was approximately 21,000 yards.

(4) That "It is true that the range of the guns just mentioned exceeds by over 4 miles the range of the guns as mounted in the defense of the United States proper, either on the Atlantic or Pacific coast; but it is not true that the range of those guns need remain thus restricted, since by a slight change in the mounting their range will be practically equal to that of the 15-inch 45-caliber guns above referred to."

It was admitted by our leading ordnance experts and military officials that such an augmented range could only be obtained at the expense of diminishing the weight of the projectile and hence its penetrating power. The net result is thus in favor of the heavier British guns.

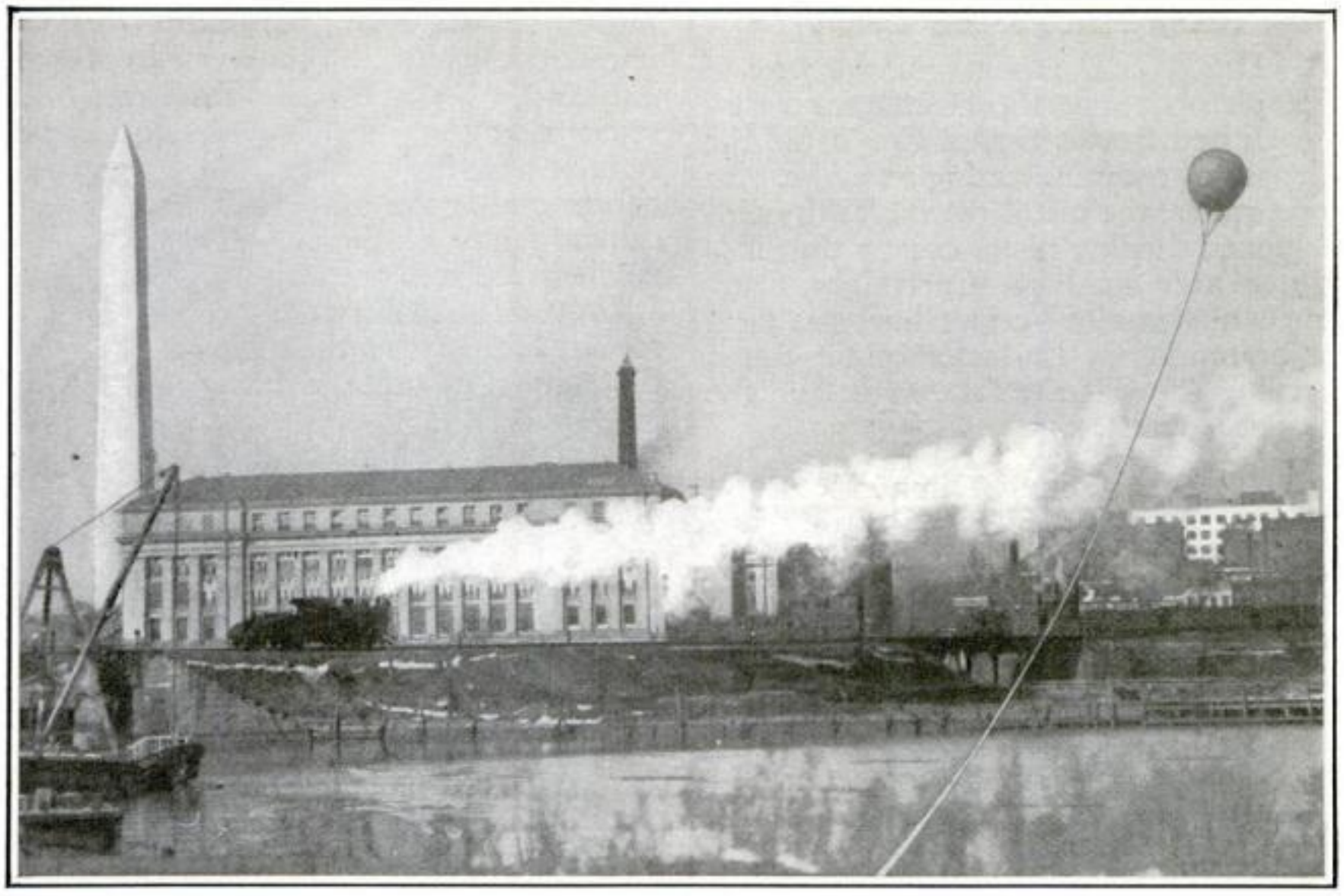
The Coast Artillery Would Fire All Available Ammunition in Forty-five Minutes

A table prepared by the Chief of Coast Artillery on December 8, 1914, and submitted to the House Committee on Military Affairs, showed that on that date 1,299 guns had been mounted and 51 were in the process of construction — only one of the latter being of 16-inch caliber; that three 14-inch guns had been mounted—that is, outside of the United States—and 21 appropriated for; that 433 modern 12-inch guns were in position and 11 under construction; while the remaining 863 already mounted and 18 appropriated for were old-fashioned 12-inch or calibers ranging down to 3-inch. Since high-powered guns have a life of only 240 rounds—or if used at the maximum, 100 rounds—it is therefore self-evident that the armament of our fortifications is sadly in need of being modernized.

On December 8, 1915, the Chief of Coast Artillery confessed to the House Committee on Military Affairs that:

"Of ammunition for continental United States we have now on hand and under manufacture 73 per cent of the allowance fixed by the National Coast Defense Board. That allowance for continental United States is the number of rounds that any given gun would fire at the maximum rate of firing in one hour."

Let the reader realize fully what this astounding revelation means. It means that the guns of the fortifications in the United States firing at the limit of their capacity would expend every bit of ammunition that they possess within 45 minutes. And the present Chief of Staff, General Scott, submitted to the same committee a statement showing that if the mortars were similarly fired they would exhaust the last round of ammunition in 30 minutes. What would happen if our fortifications were subjected to a gruelling bombardment?



A captive balloon raised above the site of the proposed power plant between the White House and Washington Monument to show how high the stacks would come

Captive Balloon Teaches a Lesson

TO demonstrate to the residents of Washington and particularly to the members of Congress, just how unsightly the effect of the contemplated new power plant chimneys really may be, the experiment was made of floating a captive balloon over the site to a height equivalent to that of the completed chimneys. The effect was startling, since the balloon, when it attained the height of the proposed chimneys, had soared to an almost unbelievable height. Inasmuch as the new power plant with its undesirable chimneys will have an effect upon the new City Park plan, many people who watched the balloon experiment made up their minds that the chimneys should never be. The question is now under discussion among interested residents.

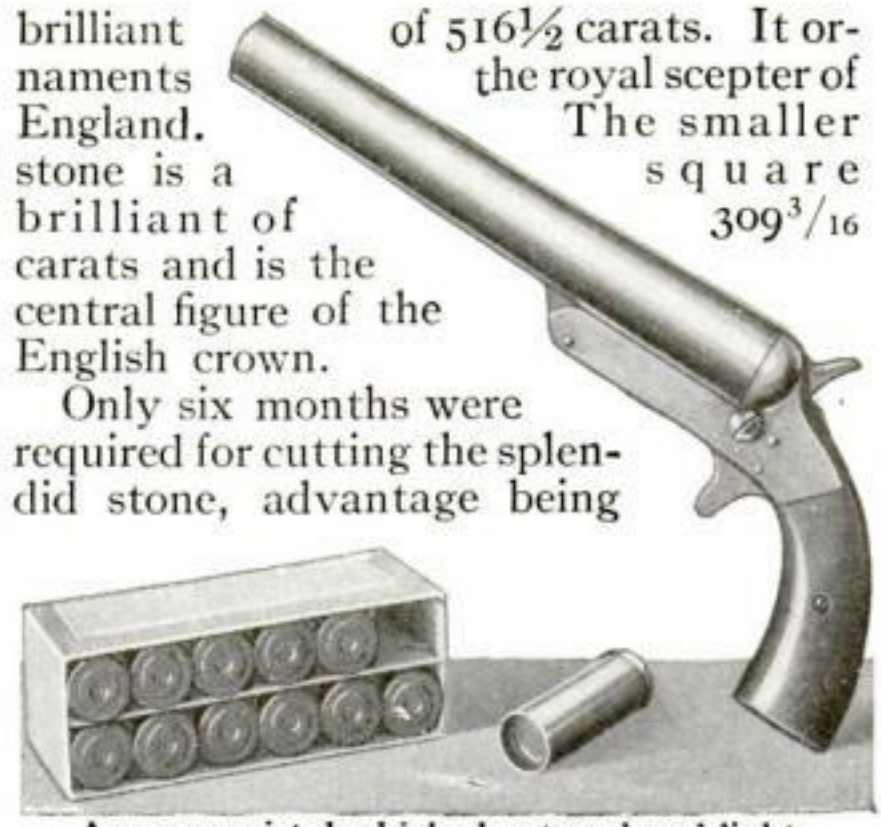
How Fast Is Your Train Moving?

A FAIRLY accurate computation of the speed of a moving train can be obtained by any keen-eared traveler with the aid of a watch equipped with a second hand. The wheels of a car produce a clacking in passing over the rail joints, the succession being divided into measures of as many beats as there are wheels on one side of the car. Furthermore, the traveler, due to his position, always hears one beat in each measure accented above the others. To determine the speed of the train, it is necessary only to count the accented beats for twenty seconds, the result being approximately the number of miles per hour of travel.

To explain this, let us say that fifty accented clicks are counted in the twenty seconds. Then the train is making about fifty miles per hour; for the fifty beats indicate that an equal number of rails have been passed over. The standard rail is thirty feet long. Hence fifteen hundred feet are being covered every one-third minute, or two hundred and seventy thousand feet per hour; which, divided by five thousand two hundred and eighty, gives fifty-one and one-seventh miles per hour as the actual speed. It will therefore be seen that the original count (number of beats in twenty seconds) comes close enough to serve the purpose.

Army Pistol Shoots Colors

A DECIDED novelty in the way of pistols has been perfected for use by the United States Signal Corps for the purpose of communicating at night. In appearance, the pistol resembles the old-fashioned dueling pistol except that it is lighter and smaller. Cartridges firing spurts of flame of various hues are used for ammunition, the color of the flame carrying a definite message to the distant lookout.



An army pistol which shoots colored light

A One-Pound Diamond

THE great diamond mines of the Transvaal have been revealing their age-long secrets for many generations, but the greatest surprise of all came on the twenty-fifth of January, 1905, when

One and one-third pounds was the weight of the famous Cullinan Diamond. It was cut into two large gems and over a hundred smaller brilliants

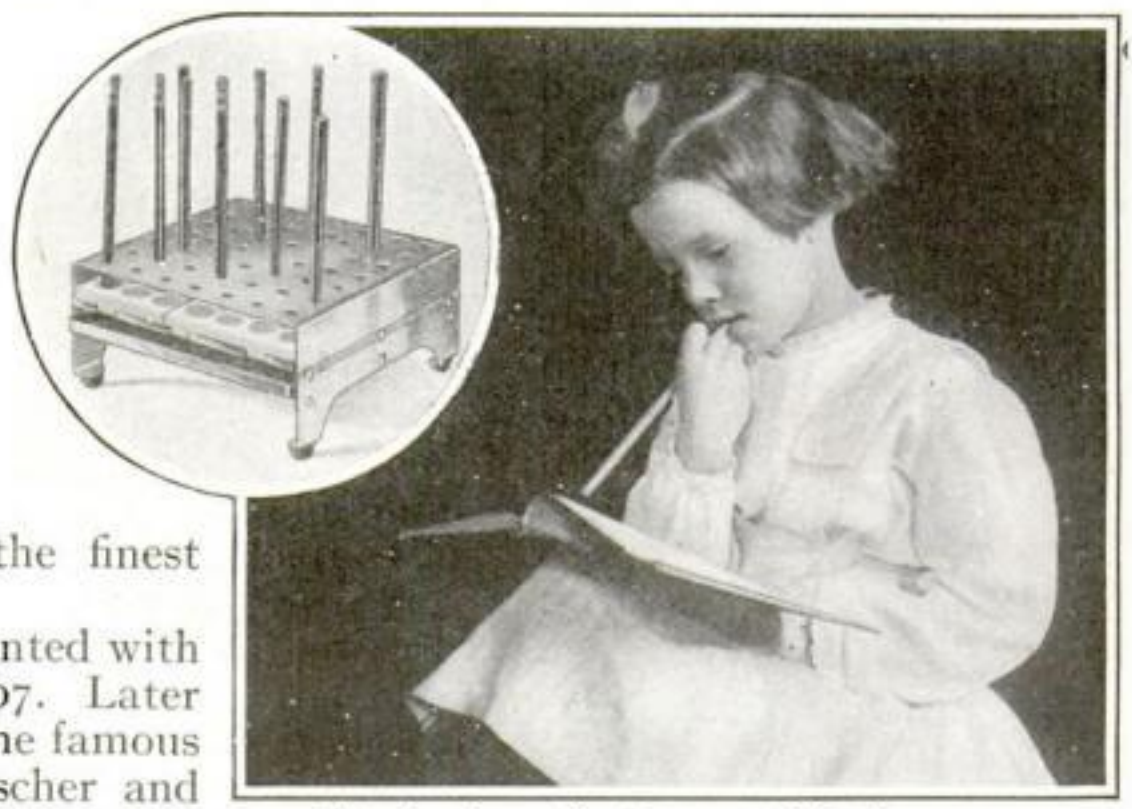
the Cullinan stone, afterward named *Star of Africa* by George V, was discovered. When the excited owners placed the colossal gem on the scales they found it weighed 621.2 grams, about one and one-third pounds. It was more than three times the size of any diamond ever found before or since, weighing 3,025¾ carats, and of the finest quality.

King Edward VII was presented with the stone on his birthday in 1907. Later it was placed in the hands of the famous Amsterdam firm of I. J. Asscher and Company who cut it into two large stones and over a hundred smaller ones. The larger jewel has the exceptional number of seventy-four facets being a drop of 516½ carats. It ornaments the royal scepter of England. The smaller stone is a square brilliant of 309 3/16 carats and is the central figure of the English crown.

Only six months were required for cutting the splendid stone, advantage being taken of the planes of cleavage.

Disinfecting School Pencils

IT has long been recognized that the school pencil is a fruitful source of disease. The pencil points are usually given a bath by the child's placing it in his mouth to soften the lead. Then the pencil is passed on to another child, who does the same, thereby spreading all kinds of communicable diseases. The pencil is disinfected by a new system, through the action of formaldehyde gas upon the bacteria.



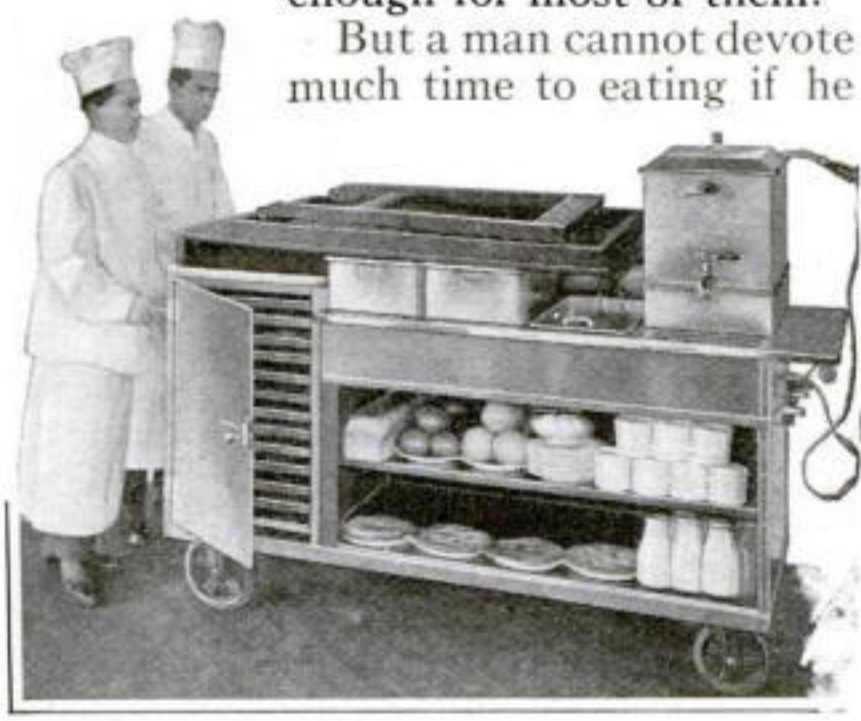
The lead-pencil of every child is a germ-carrier. Disinfect the pencil with formaldehyde gas, as shown by the picture in the circle, and the spread of disease in schools will be reduced

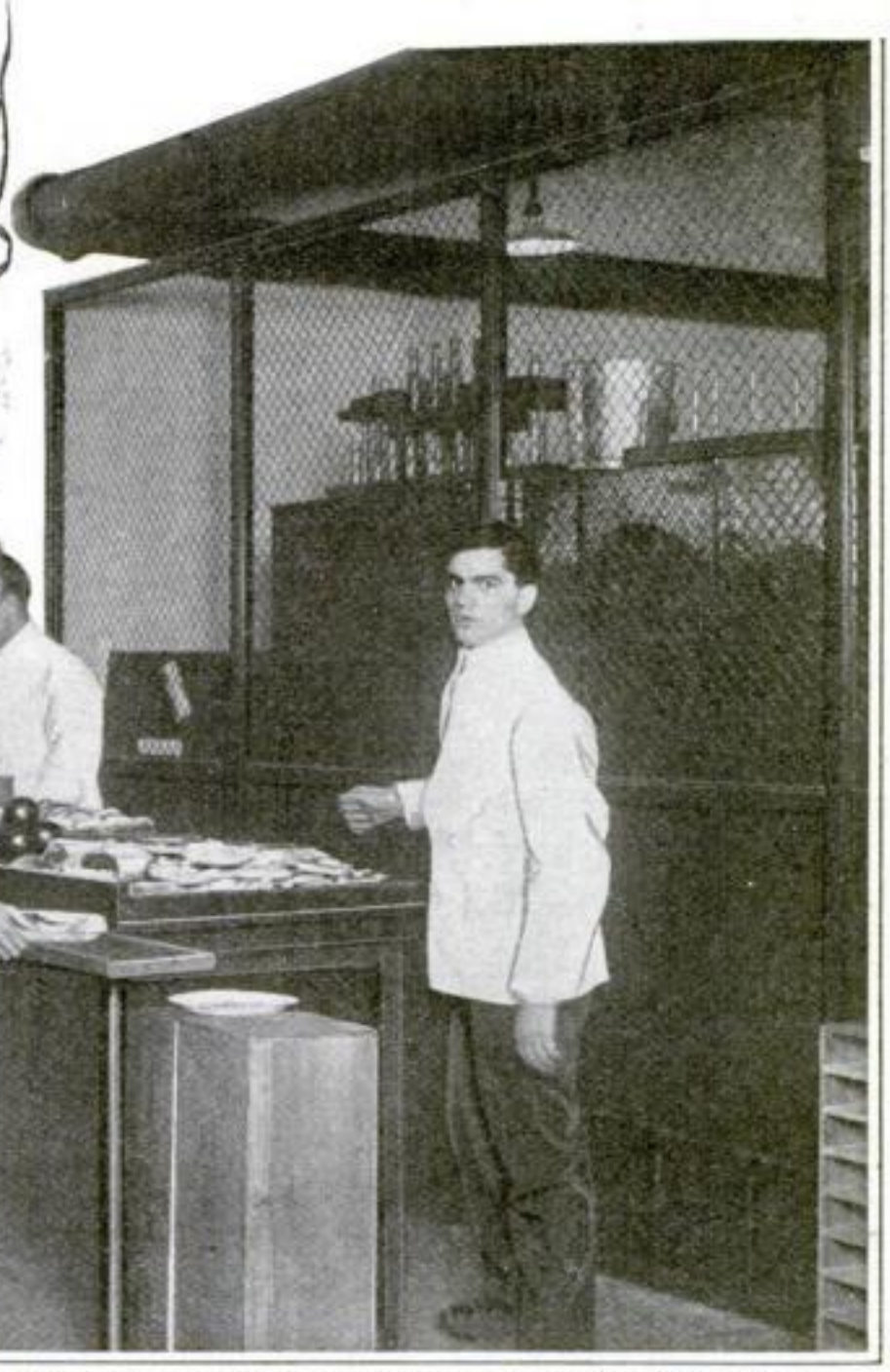
Serving Food on the Run

THE war has done many unexpected things in this country. It has touched the every-day facts of life in a degree unimagined prior to August 1, 1914. It has even affected the manner in which food is served. Since the war began, the Remington Arms and Ammunition Company has erected a plant at Bridgeport, Conn., which is more than a third of a mile long. This plant, with a capacity for eighteen thousand men, is working throughout the twenty-four hours in eight-hour shifts. As soon as a man leaves his machine, another takes his place. Men working for only eight hours a day, do not require, and, if they are working on piece, do not desire, a full hour for meals. A half-hour is long enough for most of them.

But a man cannot devote much time to eating if he must walk a third of a mile in search of food and then return to his place. So a "cafémobile" has been invented to meet his requirements. This, in fact, is a lunch counter on wheels. It is supplied with metal compartments for different kinds of food which should be warm when served, as well as for fruit, sandwiches, pies, etc. At different points throughout the factory provision has been made for attaching it to an electric circuit. By this means the soups, hash, potatoes, coffee, and meat can be heated readily.

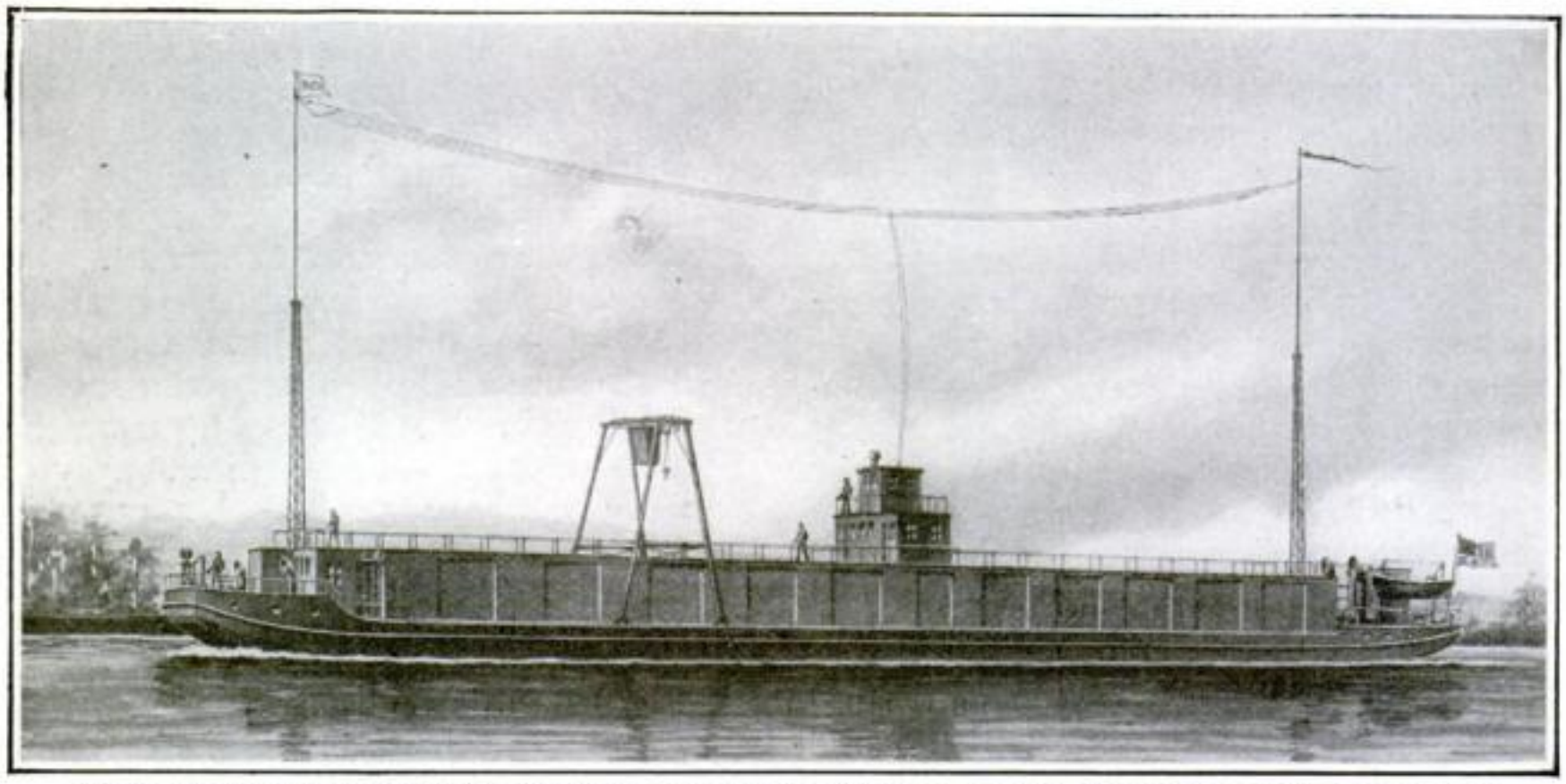
Just before the lunch hour the squadron of "cafémobiles" sets out from the restaurant, each loaded with a supply of food. These are pushed by men in white caps, blouses and aprons. Each is trundled to a different place in the factory, previously assigned, and takes up a position near the electric connection. The folding counter is turned back and the oranges, apples, pies, sandwiches and milk set out in tempting array.





In turning out high-priced munitions every minute is precious for the men in the factories. So, a Bridgeport firm uses the "cafémobile"—a lunch-counter on wheels which saves the machinist on piece-work the time required to walk a third of a mile from his lathe to his food. By means of electric connections, foods are served hot

Exit the Mississippi Stern-Wheeler; Enter the Motor-Barge



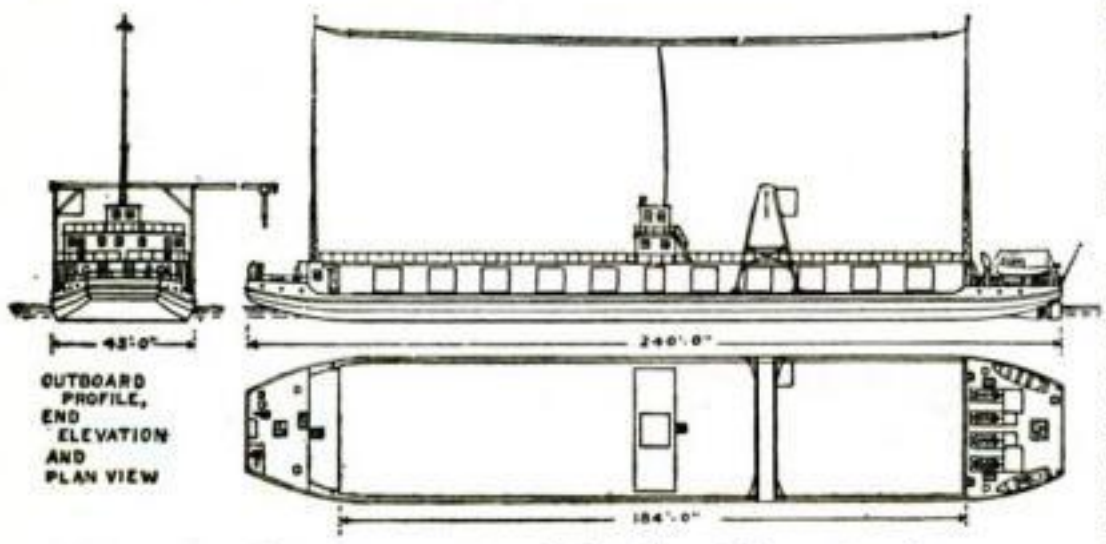
Motor-barges equipped with traveling-cranes, wireless apparatus and other modern apparatus, are to supplant the romantic Mississippi stern-wheeler

THE old, picturesque stern-wheel Mississippi freighter and passenger boat has a rival in a new type of barge.

The first of these boats is two hundred and forty feet long, forty-three feet wide and has a cargo structure two hundred feet long, forty feet wide and twelve feet high. The roof of this box-like structure can be removed in its entirety or in sections so as to permit access to any part of the cargo. The stowage of the cargo is facilitated by the use of an electrically-operated traveling-crane, which is capable of sending a boom on either side of the barge a distance of sixty-eight feet, which can travel along the whole length of the barge and which has a lifting capacity of three tons.

These two-thousand-ton barges have a steel hull divided into four watertight and airtight compartments, with no hatches. Hence the boats are practically unsinkable. A puncture of the bottom will not permit water to enter faster than it will compress the air in each compartment to a given point. Should any accident puncture a compartment at any other place, powerful electric bilge-pumps, capable of discharging eight thousand gallons per minute, can be operated by a switch located in the pilot-house.

Another commendable emergency machine is a bow-pump, with suction and discharge at port and starboard at will. By turning a switch the pilot can suck away the water at one side and discharge it at the other with a resultant pull of twenty-five horsepower, which enables the vessel to turn from the dock against a forty-mile wind.



Diagrams showing structural details of the motor-barges

As the illustrations show, the living quarters, engine-rooms and pilot-house are entirely separate from the hull proper and the cargo spacing. Forward on the main deck are located the dining-room, the galley, and the large kitchen,

which last is equipped with an electric stove, a dish washer, an ice plant and other necessary auxiliaries.

The engine-room, located aft, contains four eighty-horsepower engines which drive four screws fifty-one inches in diameter, so that the barge can travel at a speed of ten miles per hour in slack water, seven miles upstream and twelve miles when running with the current or downstream.

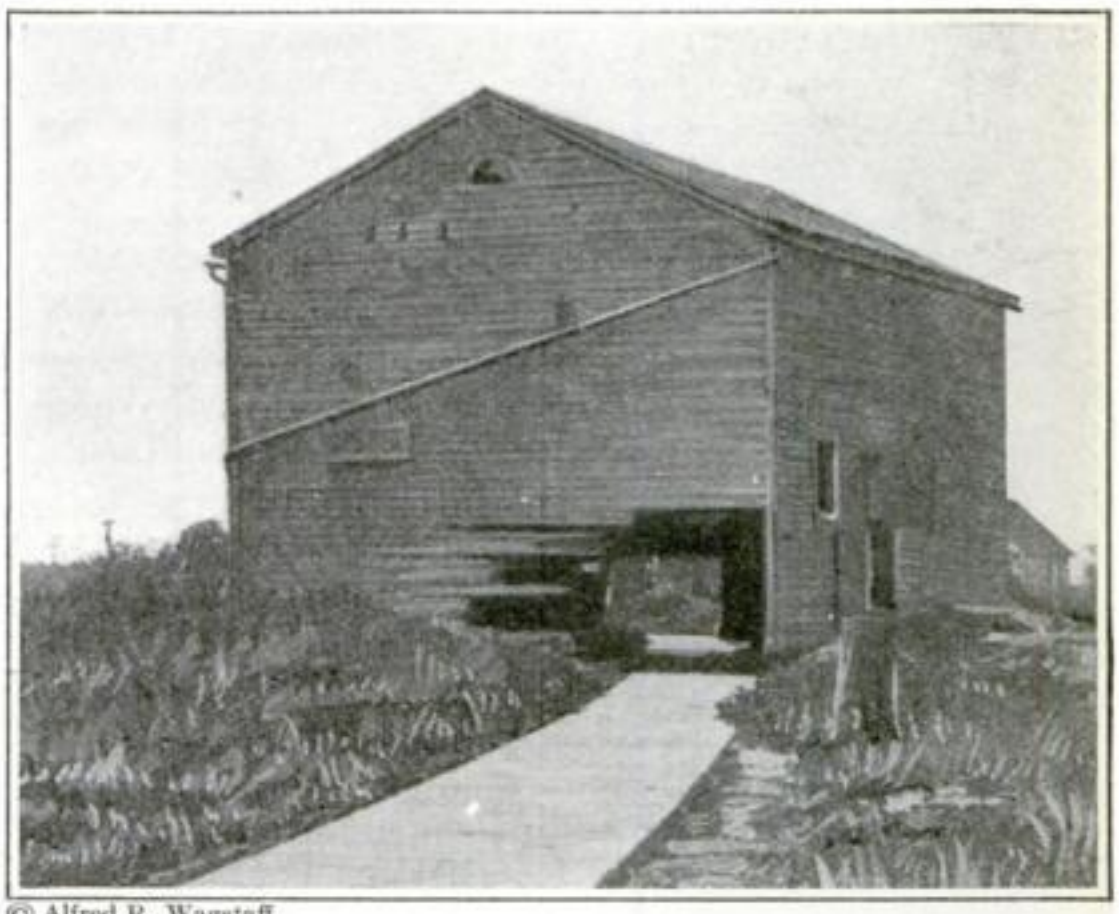
To facilitate the handling of these large cargo-carriers further, many recently invented marine appliances are installed, such as telephone service, wireless outfit, searchlights, and a system of indicators located in the pilot-house, by means of which the captain can almost instantly tell the condition prevailing in any part of his ship.

These barges can deliver freight at New Orleans five days after leaving St. Louis, a very much faster schedule than anything heretofore attained by the old type of stern-wheeler.

An equestrian milkman of Buenos Aires. If he gallops he may deliver butter

This Barn Bears a Lesson to Pacifists

THE well-known contrariness of the middle-western farmer was illustrated in an amusing way recently when an Illinois contractor requested a farmer to move his barn out of the right of way over which a concrete sidewalk was planned to be run. The farmer ignored the contractor's request. Then one bright morning the contractor smashed holes through each end of the barn and, despite the farmer's angry protests, the sidewalk was laid through it and on the way to its eventual destination.



© Alfred R. Wagstaff.

The owner of this barn refused to remove it when the landlord's contractor wanted to make a concrete path where it stood. Hence the result shown

"Quiere Leche Hoy?"

DOWN in Buenos Aires the apartment houses do not have dumbwaiters and the milkman does not come rattling and clanking across the cobblestones in front of your home at approximately four A.M. By that hour he is just about preparing to leave his hacienda with a full milk can strapped to either side of his horse. Arriving in the city he will make his rounds, stopping at his various customers to inquire *Quiere leche hoy?*—"Any milk today?" Some milk peddlers announce their presence as they canter along by loud shouts. But this practice is generally discouraged, as Buenos Aires is a quiet city, resenting vulgar hallooing in its orderly streets.

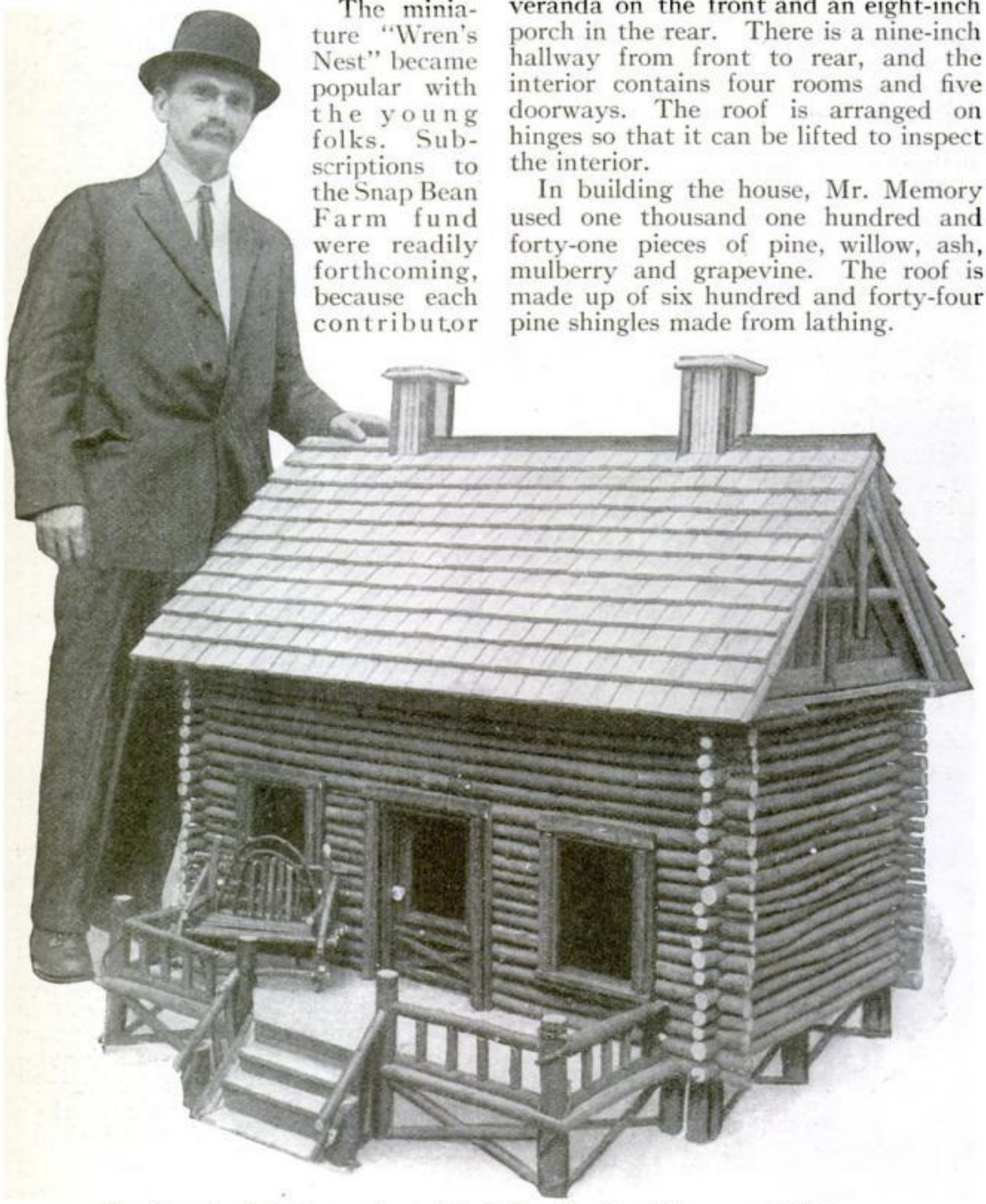
A Model of Joel Chandler Harris' Old Homestead

FOR the encouragement of a fund for the purchase of Snap Bean Farm, famous as the home of Joel Chandler Harris ("Uncle Remus"), a doll's house made to resemble the Harris home—"Wren's Nest"—has been built by Eli J. Memory, of Richmond, Va.

The miniature "Wren's Nest" became popular with the young folks. Subscriptions to the Snap Bean Farm fund were readily forthcoming, because each contributor had an opportunity to draw for the doll's house.

The little house required two arduous weeks for its construction. It is made of eighty tiny "logs" cut along the banks of Peachtree Creek near Atlanta. The structure is forty-five inches long, forty-three inches high and twenty-eight inches wide. It has a twelve-inch veranda on the front and an eight-inch porch in the rear. There is a nine-inch hallway from front to rear, and the interior contains four rooms and five doorways. The roof is arranged on hinges so that it can be lifted to inspect the interior.

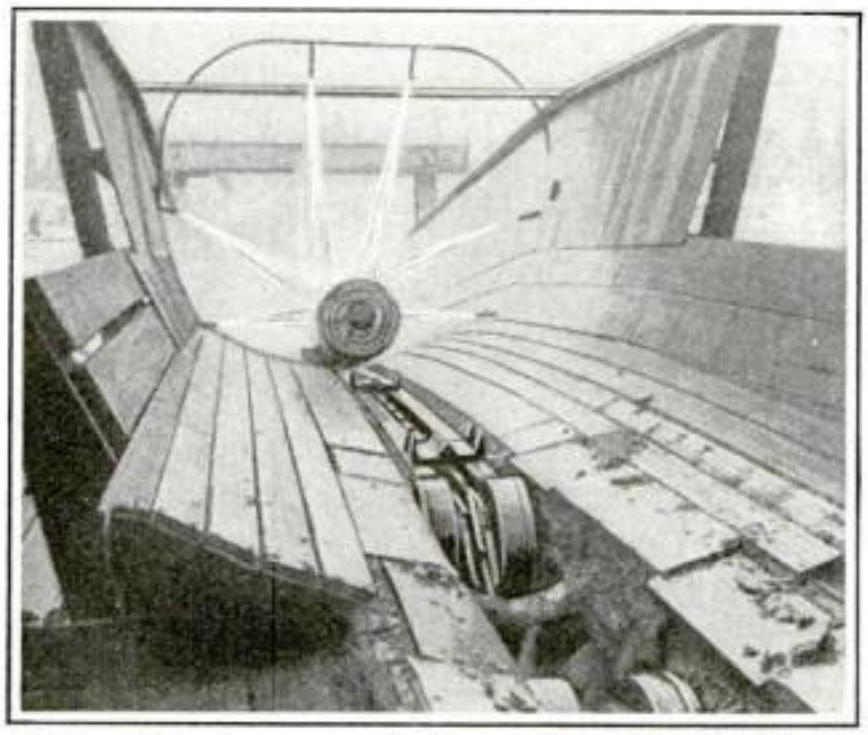
In building the house, Mr. Memory used one thousand one hundred and forty-one pieces of pine, willow, ash, mulberry and grapevine. The roof is made up of six hundred and forty-four pine shingles made from lathing.



To raise a fund for the purchase of Joel Chandler Harris' home, a doll's house, a replica of the Harris home, was made the prize in a lottery

Washing Logs for Safety

WASHING logs for safety before they go to the sawmill is the novel method employed in a lumber camp in the West. As the photograph shows, the logs are carried in a V-shaped trough upon steel rollers which convey them between jets of water of great force. These jets strike the surface of the logs, scouring them thoroughly on all sides. The result is that the bits of broken stone or other hard material that might cling to the rough bark are removed, and danger to life as well as damage to property is averted, for if a swiftly rotating saw hits a rock or nail in a log it is likely to explode like a bomb and send fragments of steel in every direction. The washing of the logs before they go to the saw is thus a safety measure well worth while.



Jets of water scour the log and remove broken stones—a safety measure for sawmills

Twitching Muscles by Means of the Electric Current

IN the treatment of certain ills it is often desirable to introduce exercise, but in cases of prolonged illness, the muscular effort is often beyond the power of the patient. To overcome this inability to exercise, numerous devices have been invented to provide automatic exercise. One of these, much used in sanatoria, where natural methods instead of drugs are relied upon, is the "sinusoidal bath" with its many variations.

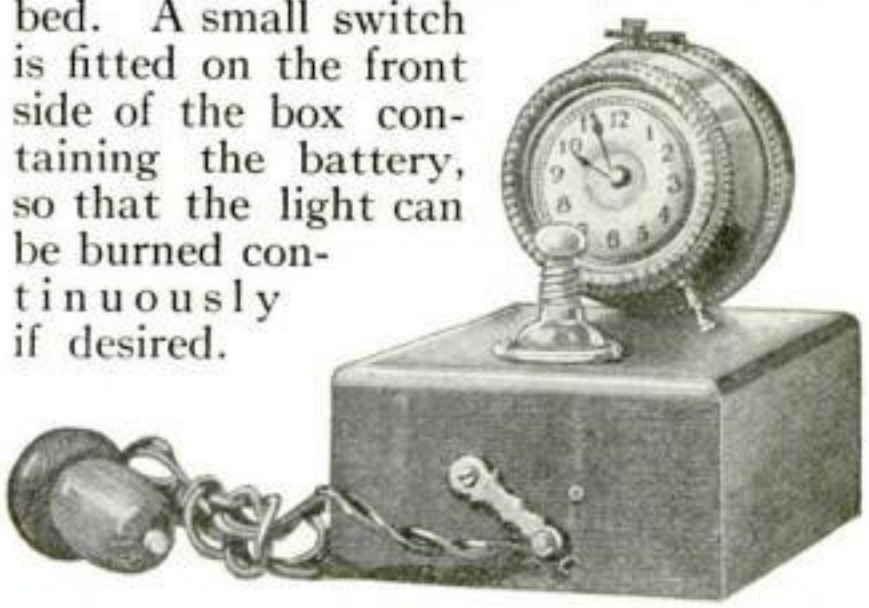
The bath is comparatively simple in its operation. The unit tubs and warm water provide electrical contacts; the sinusoidal apparatus is attached to an ordinary light socket. The sinusoidal current, which is painless in its application, will produce muscular contractions,

The man is taking a "sinusoidal bath." His arm and leg muscles are being twitched electrically to give them much-needed exercise

mild or violent at the will of the operator. The length of the contraction is regulated by a clock which breaks the current. The current may be applied in the four units simultaneously, but as a rule, the curative quality is best transmitted by alternate application. A treatment usually lasts from twelve to fifteen minutes.

An Electrically-Lighted Clock

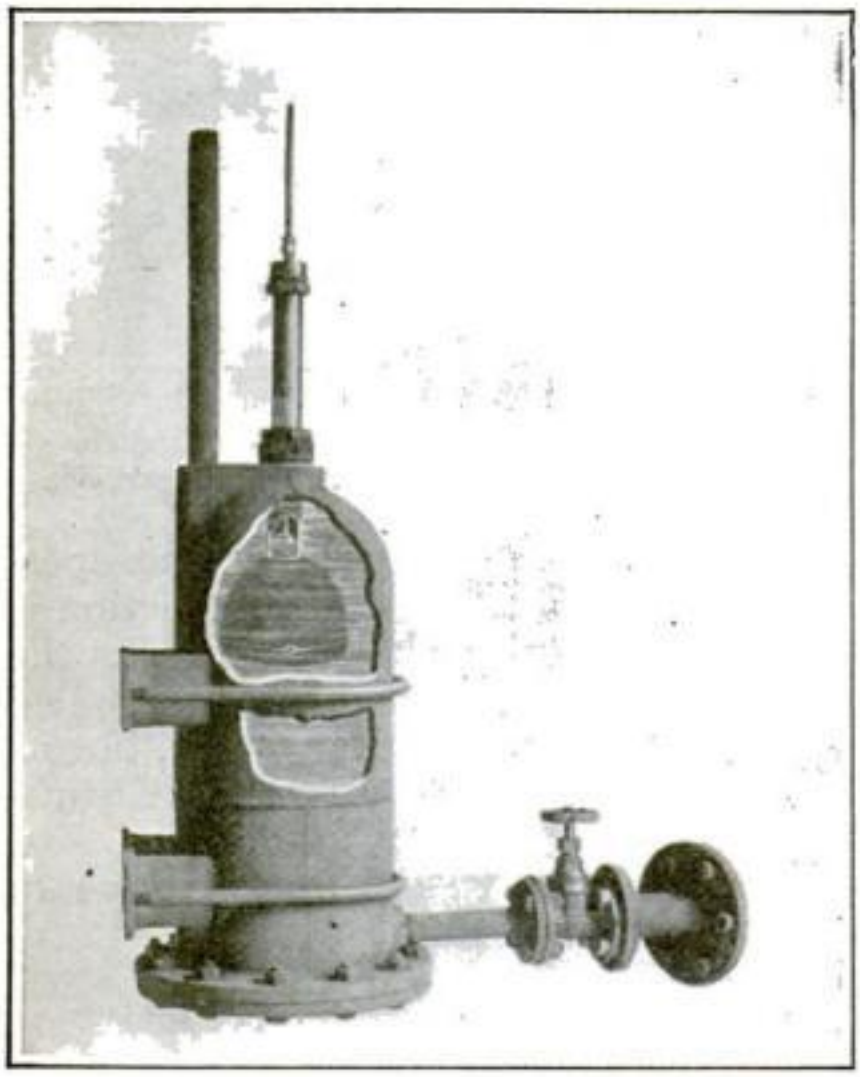
A NEW YORK manufacturer has recently brought out a compact electrically-lighted clock, provided with dry cells and a press button attached to the end of a cord long enough to reach from a nearby table or dresser to the bed. A small switch is fitted on the front side of the box containing the battery, so that the light can be burned continuously if desired.



The long cord runs from the clock to your bed. To find out the time without getting up, press the button at your end of the cord. The clock is illuminated at once

Making a Life-Saver of a Leak

WHEN a heavy sea is running, one of the glass-covered portholes in the bow of a steamer is often crushed in—an accident which, while seemingly unimportant, has resulted in the foundering of many a ship. Water rushes into the opening at the rate of many gallons a minute. Should the crew be occupied in other parts of the ship in clearing decks or battening down hatches, the broken port is likely to escape notice until enough water has entered to make the situation really serious.

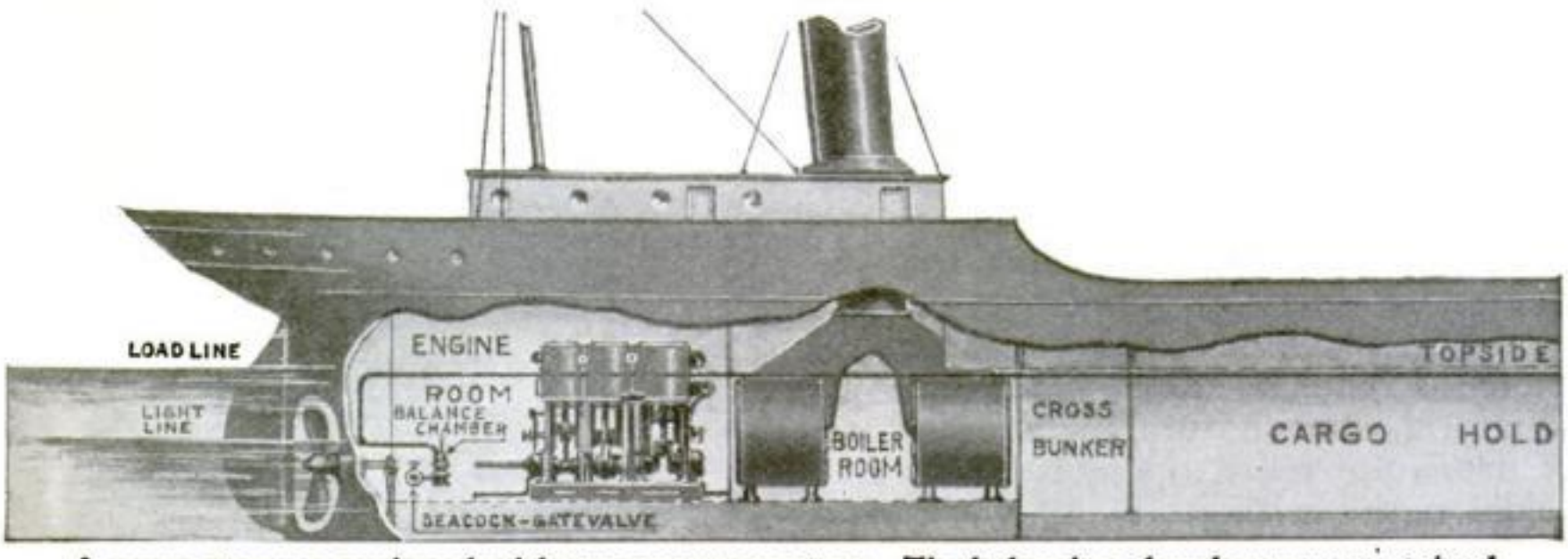


The water tank covers a hole in the ship's side. Part of the interior is shown so that the balancing-chamber can be seen. The small tube at the top leads to the mercury gage which tells whether the ship is listing or not

An automatic registering device with a dial in the chart room or captain's cabin has been installed on several freighters, to indicate within a fraction of an inch exactly how much water the vessel is drawing both forward and aft. The instrument has been applied to other uses, such as measuring the depth of rivers and the amount of oil and other liquids in tanks aboard ship and ashore. In all of these applications the principle of the device is the same.

The natural law which governs the operation of the "pneumercator," as the invention is called, is nearly as old as mechanics. Simply expressed, it is that the weight of liquids having the same cross-section is directly proportional to the depth.

Described in a few words, the device consists of a pressure-gage, which registers the weight of liquids in which it is sunk, and by means of a tube containing air indicates the pressure on a wall-gage. The apparatus is made up of three essential parts: a balancing-chamber, an indicator and a small pressure-pump. The balancing-chamber is connected by copper pipe line with the indicator, and the indicator is connected with the pump by means of another pipe line.

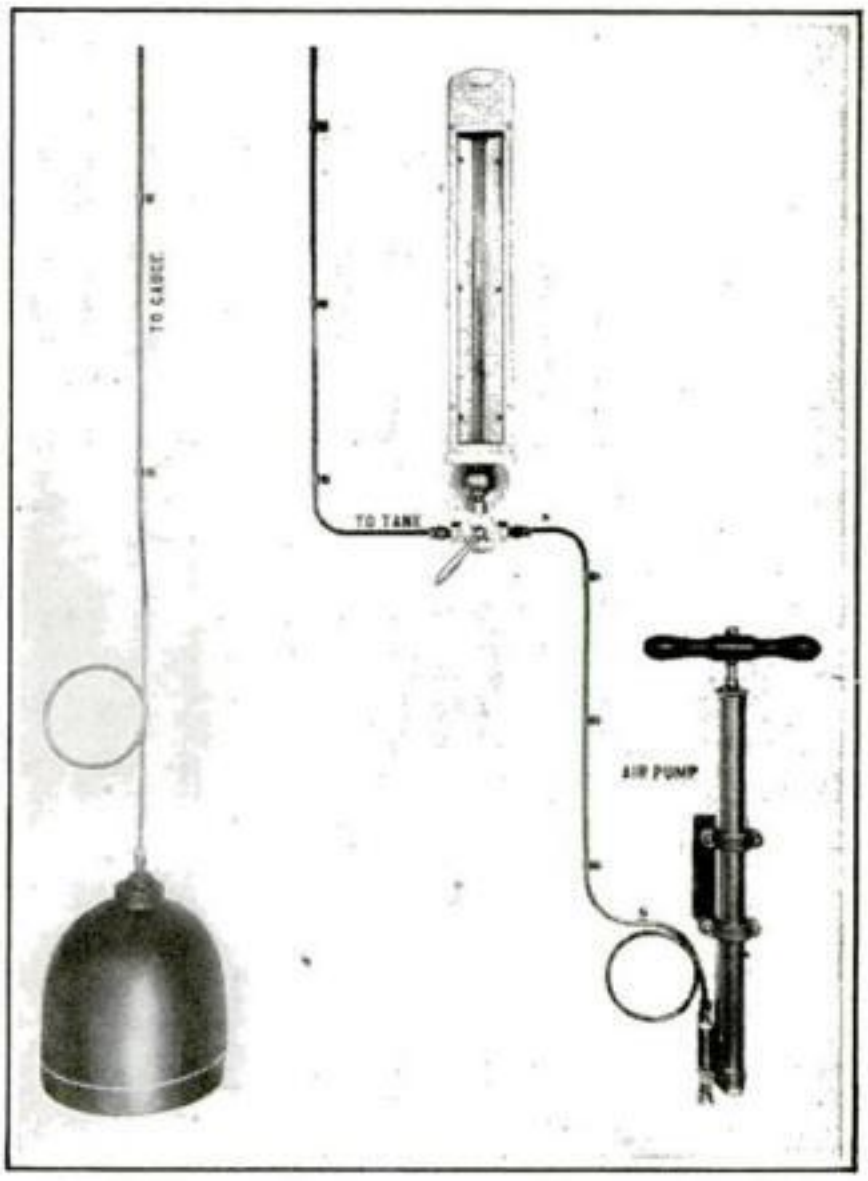


A cargo steamer equipped with two pneumercators. The balancing-chambers are contained in the tanks which are indicated in the bow and stern. Holes in the ship's side, which allow the tanks to be filled, are placed a few inches below water line when the ship is unloaded.

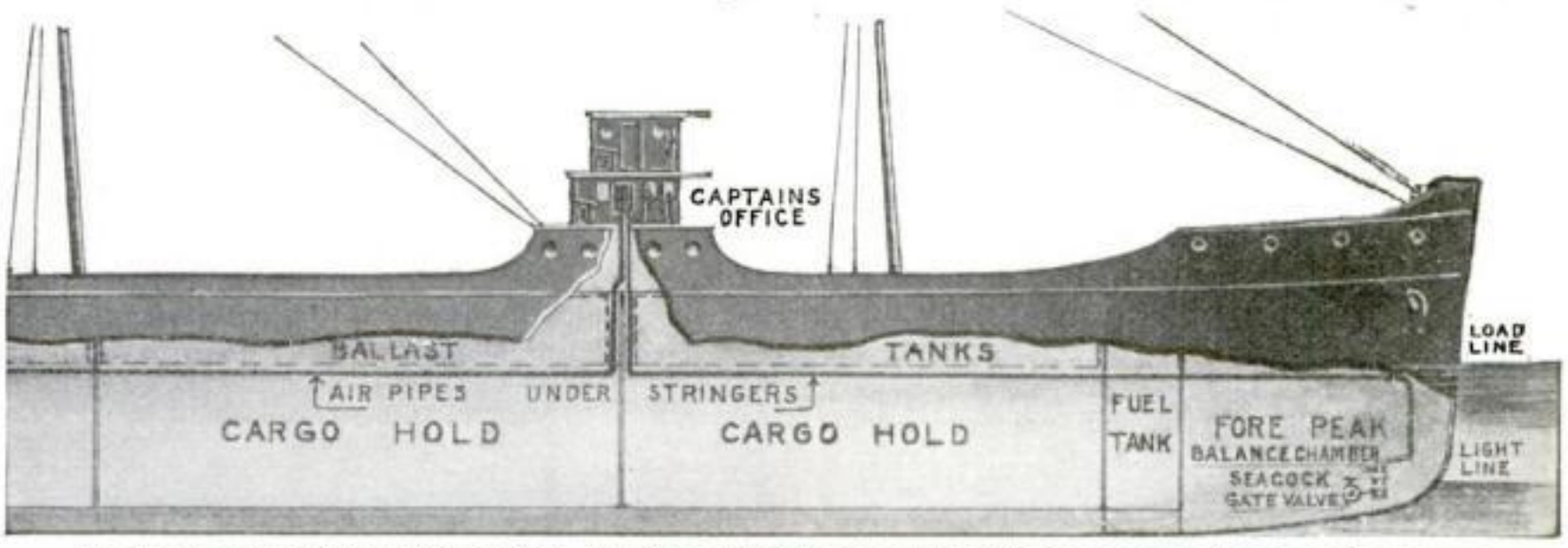
The balancing-chamber is a small metal bell with a tube at the top and a small hole in the side near the bottom. When the balancing-chamber is sunk, liquid is forced into the hole, the resultant pressure being transmitted through the pipe to the mercury indicator. The indicator resembles an old-style barometer, having a tall mercury column. As soon as the balancing-chamber has been sunk to the bottom of the tank the mercury column will rise no higher; it is then necessary to balance the system by means of compressed air. This is necessary to compensate for the loss of pressure transmitted due to the length of the copper tube. A valve at the bottom of the indicator is turned so that the balancing-chamber is in direct communication with the air-pump. A few strokes of the pump force out the liquid from the sunken chamber. Then the valve is turned back to its former position and the pressure is correctly registered on the dial by the mercury column. The accompanying drawings explain the system so clearly that further elucidation is hardly necessary.

With this device it is not only possible to determine correctly the amount of water or oil in the tank—and the calibration of the gage can be easily translated into gallons—but it can be employed for determining the tonnage of a vessel by the use of a balancing-chamber in the bow and another in the stern. Both of these chambers communicate through tubing to twin dials located in a convenient place.

Two of the accompanying diagrams illustrate the manner in which the apparatus is installed for determining a ship's draft. A one-inch hole is bored in the bow a few inches below the water line when the vessel is unloaded. If four equipments are installed instead of two—one on the port side and the other on the starboard side in the bow and the other two installed similarly in the stern, it is an easy matter by having the four gages side by side to tell whether the ship is



The bell-like object is contained in a small tank which communicates with a hole below the water line in a ship's side. The variations in water pressure are communicated to the gage. The purpose of the air-pump is to balance the system for accuracy



As the vessel sinks in the water, due to natural or accidental causes, the increased pressure is transmitted through copper tubing to indicators in the cabin's office, the chart-room or the engine-room, giving due warning to the officers of the ship

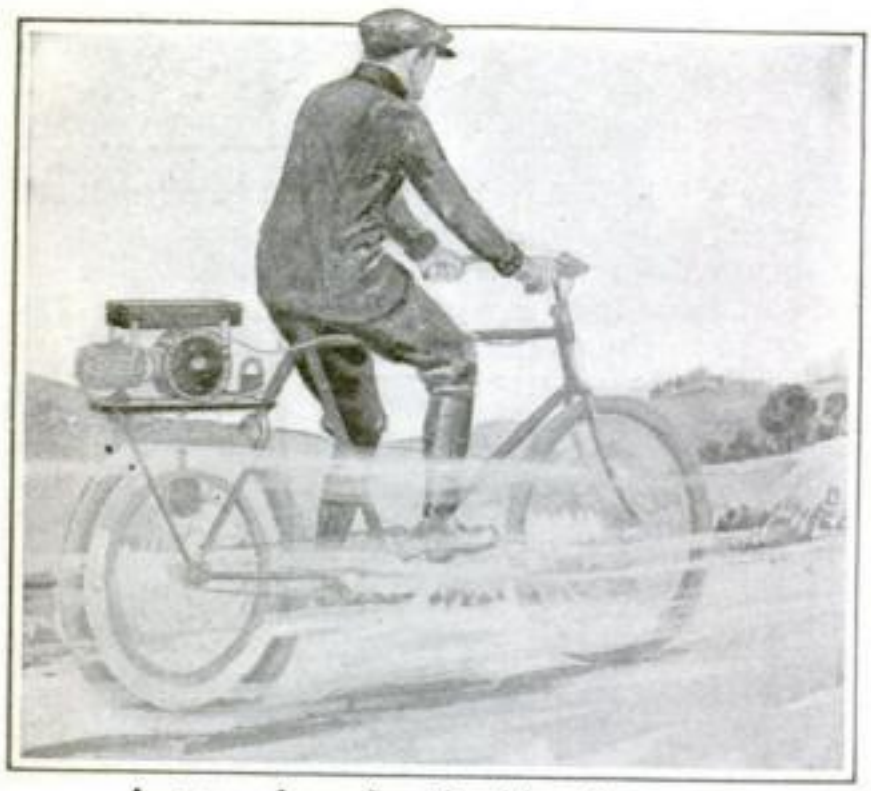
properly trimmed or not. It is this system of installation which will give indication in the pilot-house or engine-room when the ship springs a leak. It is also possible to tell after the ship springs a leak whether the pumps are taking care of the inrush of water or not. By means of an electrical attachment to the mercury indicator, warning bells can be rung when a dangerous height has been reached by the mercury column, or, in other words, when the ship is listing in any quarter.

The possible uses of the pneumercator are almost limitless. It can be employed in oil fields, at hydroelectric plants, on warships, on gasoline engines and, in fact, any place where accurate pressure gages are necessary.

A pneumercator is installed on the U. S. S. *New York* for indicating the amount of oil in the auxiliary tanks.

A New Way of Driving a Bicycle with a Motor

ONE of the most ingenious motor attachments for bicycles yet placed on the market has recently appeared in England. The motor, which develops slightly over one horsepower, is attached to the luggage-rack; it weighs but sixteen pounds and occupies little space.



A new place for the bicycle motor

A V-shaped belt-rim is attached to the back wheel, and on this fits a friction-wheel, which is chain-driven from the motor. A lever operated from the handlebar lifts this wheel from the rim, and thus provides a free engine and clutch.

The motor is said to develop sufficient power to drive the machine at the rate of twenty miles an hour, although on a steep hill, the rider must help the motor by pedaling.

The makers assert that they can place this little machine on the American market at a cost of about fifty dollars. The expense of operating will probably be small, as the engine is designed to run nearly one hundred and fifty miles upon one gallon of gasoline.

This electric fixture can be easily attached to any bed

Reading in Bed Made Easy

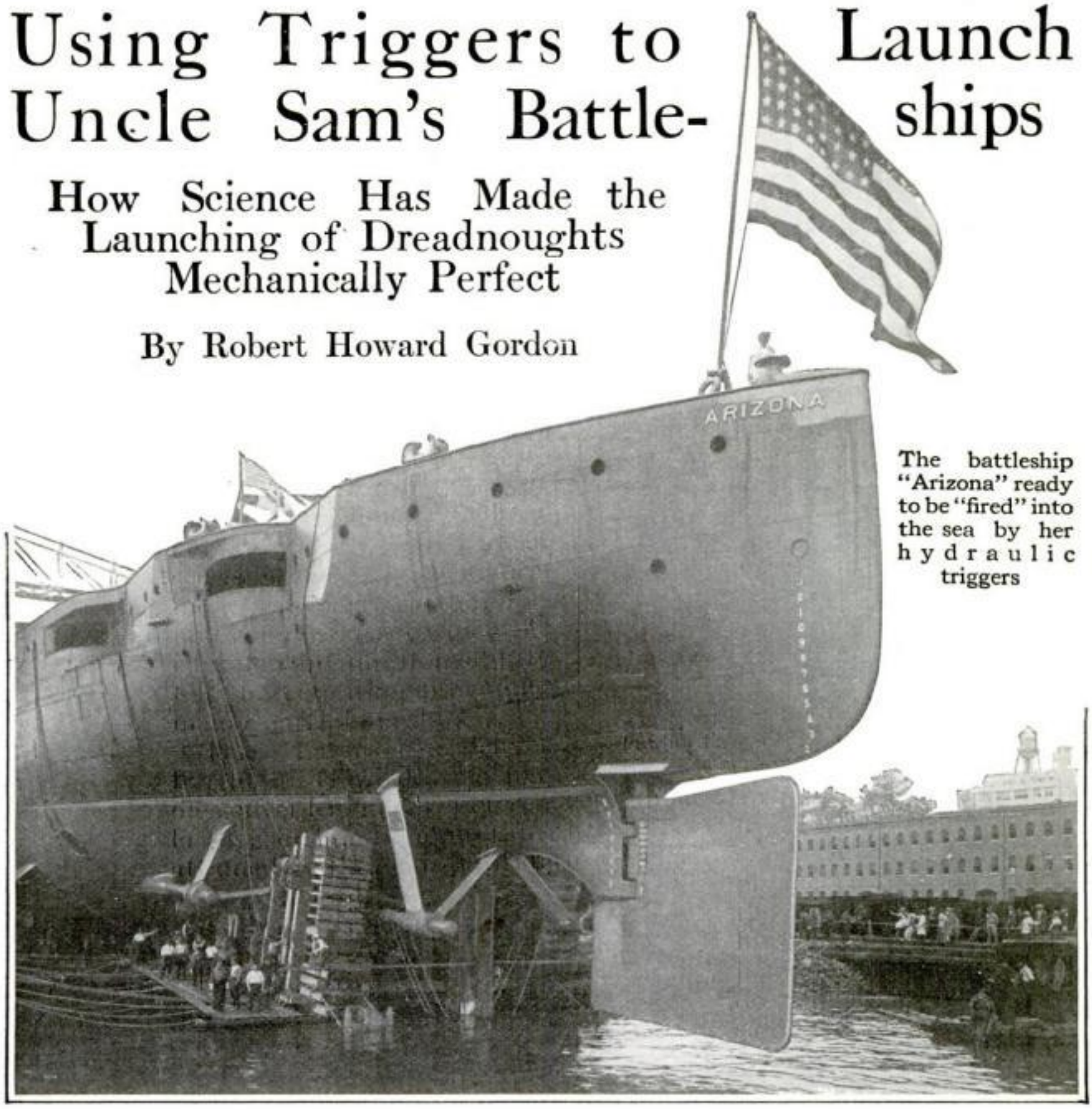
AN electric light device which can be attached to any bed directly over one's head has recently been put on the market. A strip of brass is bent into nearly a circle at one end, the other end being bent in the opposite direction to form a large hook for hanging over the headboard.

An ordinary electric socket is fitted with a short threaded tube having a flange at its outer end. This tube passes through a longitudinal slot in the brass strip and is held in place by a spiral spring which presses against the flange and the inner surface of the curve. The length of the slot permits a wide angle of adjustment of the light. This simple device may be easily attached to a desk or any other piece of furniture where a light is needed.

Using Triggers to Launch Uncle Sam's Battle-ships

How Science Has Made the Launching of Dreadnoughts Mechanically Perfect

By Robert Howard Gordon



The battleship "Arizona" ready to be "fired" into the sea by her hydraulic triggers

THE launching of a great battleship involves the problem of releasing a ship from its ways without straining the shell. In the case of such great super-dreadnoughts as the *New York* and *Arizona*, the great length and enormous weight of steel necessitate unusual care in calculating the points where the strain can be relieved by additional ways. The "ways" are of two kinds, ground ways, which are immovable, and sliding ways, which move with the ship into the water.

Ground ways consist of longitudinal timbers on either side of the keel, placed about midway between the keel and the turn of the bilge or under surface of the vessel. The sliding ways are similar and rest upon the ground ways, with a thick coating of stearin or grease between them, to facilitate the sliding motion of the hull, as shown in Figure 1.

It was thought best in launching the *Arizona* to carry the ways as far forward as possible to gain additional length of sliding ways and consequently reduce the unit pressure. The extreme narrowness of the fore part of the shell necessitated the placing of three steel-plate slings under the ship, extending from side to side and lashed to the ship by heavy, wire rope as shown in Figure 2. The space between the slings and the hull of the boat was then filled with concrete, which gave the ship a temporarily increased width forward. The under portion of the shell, in the wake of the

concrete, was greased with stearin, painted on hot, and the concrete was tied back to the slings.

The supporting structure for the aft portion of a ship must be removed before the launchings can take place (if the

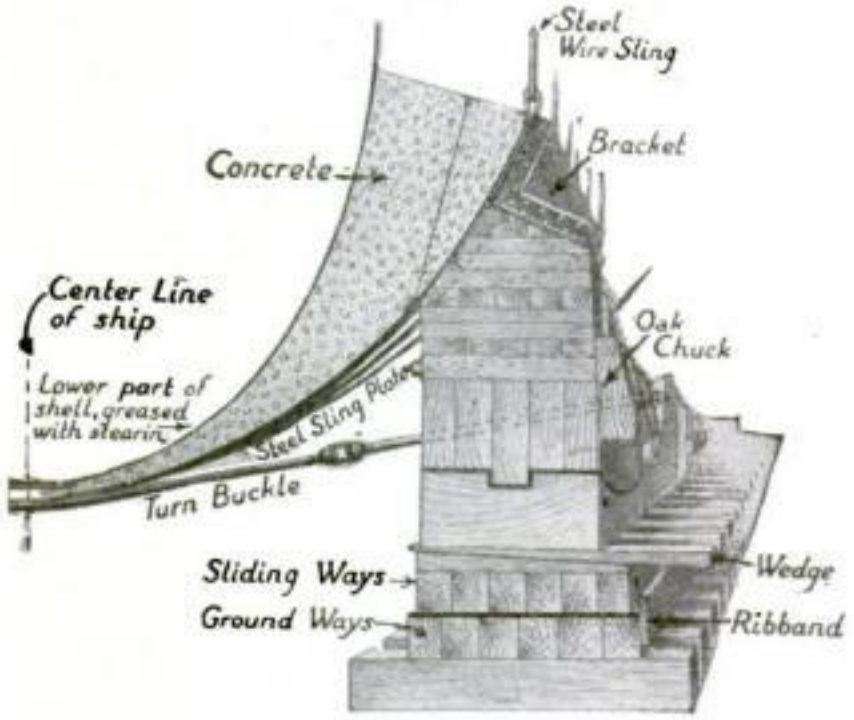


Fig. 1. Section through the fore part of the supporting structure, starboard side looking forward

stern dips into the water first), since the central portion of the hull has so much greater width. About six weeks before the *Arizona* was launched, the aft keel-blocks were removed and tumbling shores substituted. These consisted of blocks rounded off at their top, forward and bottom, after ends, thus allowing them to tumble when the ship started to move down the ways. This arrangement is illustrated in Figure 3.

The actual releasing of the ship was accomplished by means of two hydraulicly-operated triggers, one on either side of the shell and operated together. The trigger, shown in Figure 4, consists of special forged steel, the upper end engaging a cap set in the sliding ways,

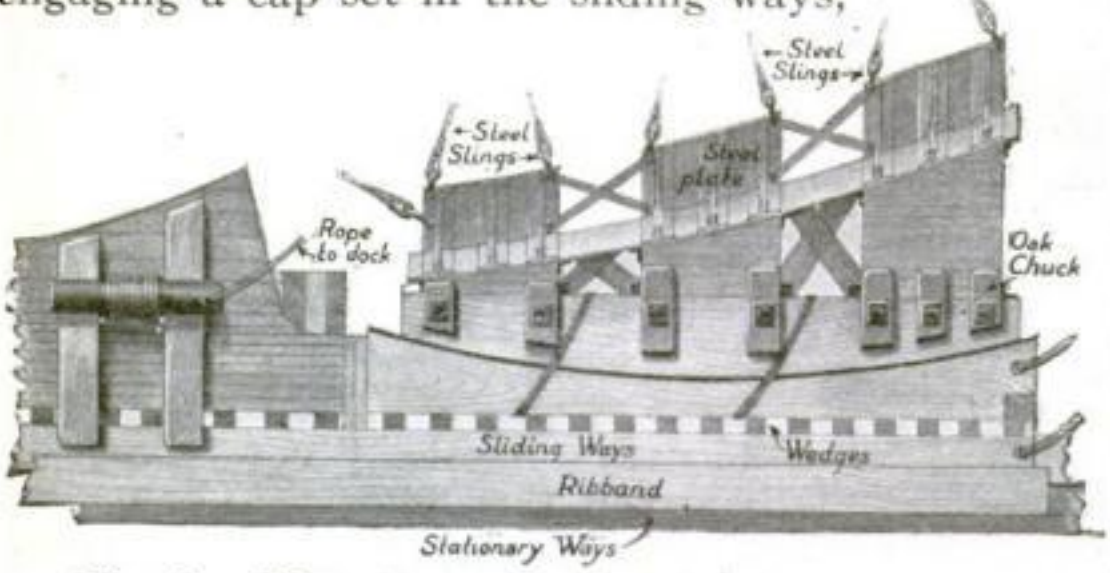


Fig. 2. View showing steel-plate slings under the narrow fore part of the vessel

and the lower end bearing against a piston, sliding in a cylinder fastened to the ground ways. The cylinder contained a thirty per cent mixture of glycerin and water. When the signal was given, a releasing valve was turned,

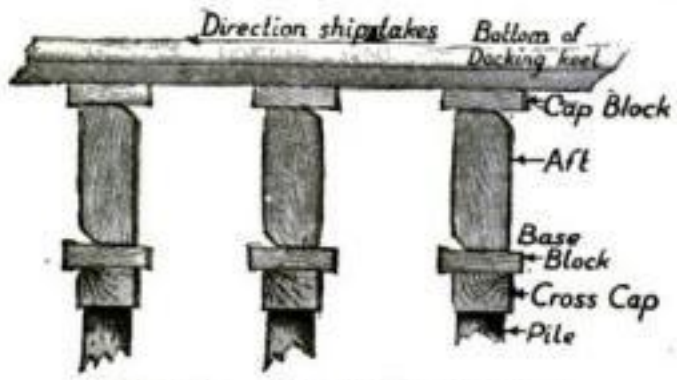


Fig. 3. Tumbling shores

allowing the glycerin in the hydraulic cylinder to escape. The pressure in the cylinder being removed, the trigger swung on its pivot, disengaging the cap and allowing the ship to move down into the water.

The effectiveness of this arrangement was proved in the launching of both the *New York* and *Arizona*. No appreciable strain was noticed anywhere, though very careful observations were taken.

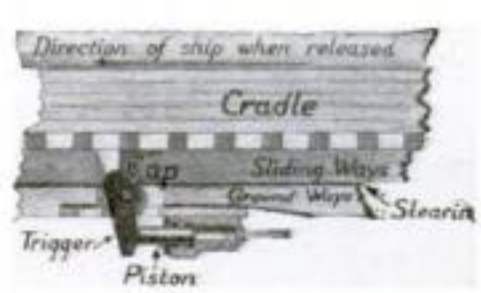


Fig. 4. The hydraulic trigger itself

Keeping Beverages Fresh

BY a new patent process grape juice, wines or beverages made from fruit juices can be so treated that they will not become turbid and will not form a sediment when stored. Also they are practically freed from any sort of bacteria.

The liquid, under regulated pressure and temperature, is passed through a finely divided mass of some material which will not dissolve or absorb moisture, such as corundum, garnet or quartz, and at the same time subjected to an electric current. If the liquid to be treated is acid, the crushed material it is passed over must be electro-negative; if the liquid is basic or neutral, the material, must be electro-positive. Alternating current is employed.

Ten-Net—An Indoor-Outdoor Game

"Ten-net," the new game, in action. On the left, the net is extended immediately after the ball has been shot. On the right is the attitude of the player receiving the ball

IF "Ten-net," a novel game invented by Halvor Achershaug, of New York, meets with the popularity which is predicted by those who have played it, both indoor and outdoor sports will be forced to look to their laurels.

Many different games may be played with the nets patented by the inventor, ranging from a modified form of handball for indoor work to an exciting outdoor game somewhat resembling lacrosse.

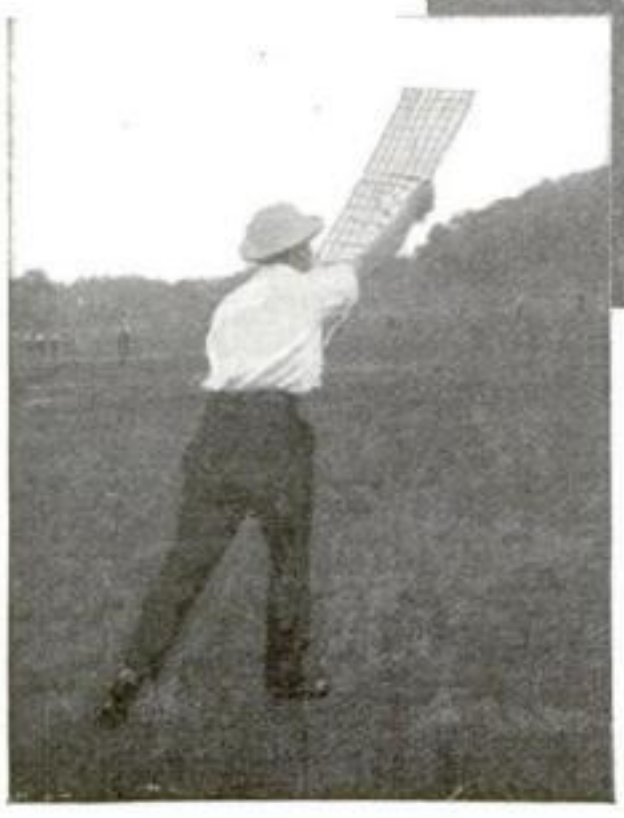
The nets are made of whipcord, fastened to two wooden handles in much the same manner that a hammock is slung between two posts. A triangular loop of resilient spring wire projects from each handle, and to this the edge of the net is securely bound.

In the center of the net is a cradle-like arrangement which is also made of spring wire. This gives added strength to the point which stands the greatest shocks during the game.

In playing "Ten-net," the players use a tennis ball, and throw it back and forth, using the hand nets both in catching and throwing. When the ball comes speeding through the air, the player spreads his net, and allows the ball to hit it. At the moment of impact, the handles are quickly brought together, and the net breaks the force of the ball. A turn of the wrist, and the net is lowered, with the ball held securely inside.

In throwing the ball, the net is used as a sling. The net is relaxed, since the handles are held close together. To get the greatest speed and distance, the net is held behind the head, and is suddenly brought forward; at the same time, the hand grips are spread apart. The ball speeds away to an astonishing distance, where it is caught by another player, holding another outstretched net.

At the right, a player about to shoot the ball into the air for a high "fly;" opening the arms throws it into the air with great force



A player receiving a ball from a high "fly." The net is held at an angle to catch the ball without having it bounce away

New York's Submarine Subway and How It Was Built

By Howard B. Gates

The author of this article is a Civil Engineer, who is connected with the Public Service Commission of New York city. His official duties were such that he was closely identified with the daring work that he so interestingly describes. Obviously, he writes from first-hand knowledge.—EDITOR.

A TWENTY-story building literally grows out of the ground over night; subways are built beneath our most congested streets and under rivers and we scarcely know they are there until they are ready for operation; our water supply is siphoned under rivers at great depths and runs through the very bowels of the earth in arteries hundreds of miles in length for our convenient use at faucet and hydrant; bridges spring from the opposite banks of our rivers and meet in the center within a fraction of an inch and we talk with our friends across the ocean and continent with perfect ease and understanding. Not only to the lay mind but to the technically trained as well, do these achievements become a source of wonder, the former accepting the result as sufficiently marvelous in itself, while the latter appreciating the underlying principles of science and laws of nature which contribute to their success, wonders at the ingenuity of their application. One of the most recent examples of these marvels of engineering is the "submarine" subway or Harlem River tubes built beneath the Harlem River to form the connecting link between the Boroughs of Manhattan and the Bronx subway systems now nearing completion.

The Harlem River at the point of this crossing is six hundred feet wide and varies in depth from twenty to twenty-six feet. In accordance with the requirements of the Secretary of War, the top of the structure was fixed at a depth which placed it an average of seven feet below the river bottom and made the lowest point in the structure about fifty-seven feet below water. To start the construction at the bulkhead lines was not practicable; hence the tubes were projected landwards, so that the total length of this special construction was one thousand and eighty feet.

The Four Tubes Floated Like Boats

Briefly, the method consisted in assembling the steel shell or form of the four tubes, in sections about two hundred and twenty feet in length upon timber supports above the water. With the ends sealed or partially closed, a section was launched and floated as a boat. Towing it to and anchoring it above its designed location, its tubes were filled with water under positive and accessible controls and gradually lowered into a previously dredged and prepared trench. As each section was lowered in turn, it was attached to the end of the previously placed section and encased in concrete. When all of the sections had been lowered and properly encased, with their ends closed by watertight walls or bulkheads, the water by which they had been sunk was pumped out, and a reinforced concrete lining was placed inside the steel shell to complete the structure.

The steel portion of the structure consists of four parallel tubes bolted together, with flat sides on their interior walls. Between the tubes are vertical diaphragm plates which are placed at intervals perpendicularly to the direction of the tracks and which extend to the rectangular limits of the structure.

Digging Trench for the Tubes in the Bottom of the River

The safe submerging of this light steel form and the temporary control and final location of it, comprise the most spectacular part of this great scheme. The trench into which the subway was to be located was formed by a "clam-shell"

dredge. While the trench was being prepared, the structural steel tubes were in process of building over a slip about a mile away.

In launching each section nine flat-decked boats similar to canal barges, were uniformly distributed beneath the structure at low tide. As the tide rose the huge steel form was lifted clear of its supports; then tugs readily towed it out of the slip. Small valves in the bottom of these boats were simultaneously opened, the section slowly settling down into the water until it floated on its own surfaces as a boat. The flat boats were ballasted with stone to overcome the buoyancy of the wood of which they were constructed and were readily pulled from beneath the structure. After they had been pumped out, they were available for use on the next section.

The flotation of the structure was made possible by the watertight wooden bulkheads which completely closed the ends of the outside tubes and the lower half of the ends of the center tubes. These bulkheads and tubes presented something of the appearance of four large submarines tied together, their ends cut off and boarded up. As the same essential principles are involved in their submersion, they might be termed, the "Subway Submarines." Their weight or displacement when entirely equipped was about seven hundred and fifty tons.

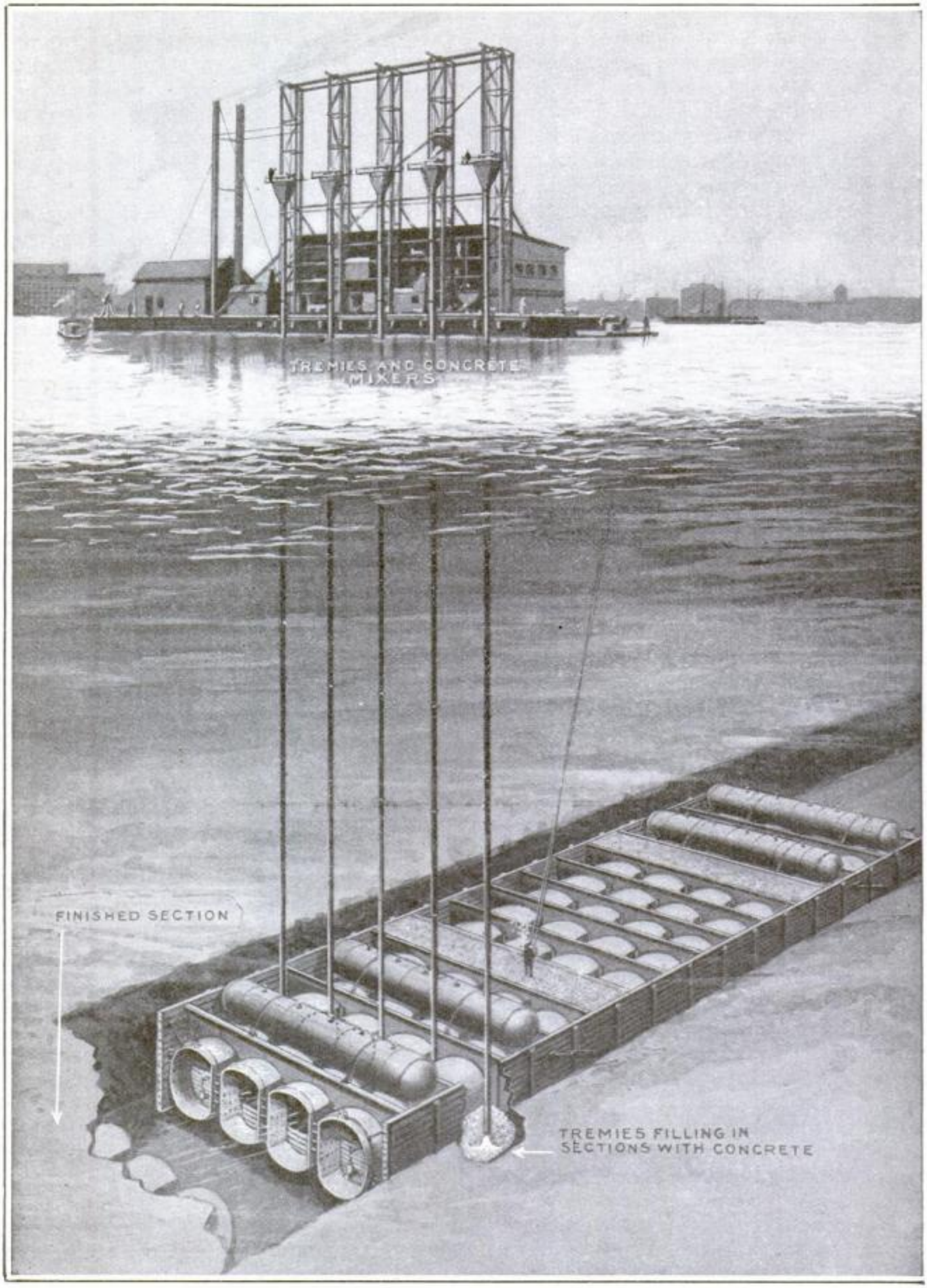
How the Tubes were Sunk

It is evident that, if the tubes are to be submerged, an enormous weight must be added to overcome the buoyancy that causes them to float. The admission of water suggests itself; but the scientist points out that this is a practical impossibility. Certainly it is a grave risk, to attempt to control and adjust the amount of water in so large a structure, especially where any tendency toward unequal settlement might cause the water to flow to the lowest points, and eventually plunge the whole structure to the bottom a hopeless wreck. It is a well-known principle in physics that the resulting buoyancy-effect of a floating body (in other words, the weight which the floating body will carry and remain floating) is theoretically equal to the weight of a volume of water of the same dimensions as the floating body, less the actual weight of the body. In the light of that principle the use of the four steel air cylinders illustrated in place upon the top of the tubes is at once apparent; they furnish the necessary suspension while the tubes are being filled with water.

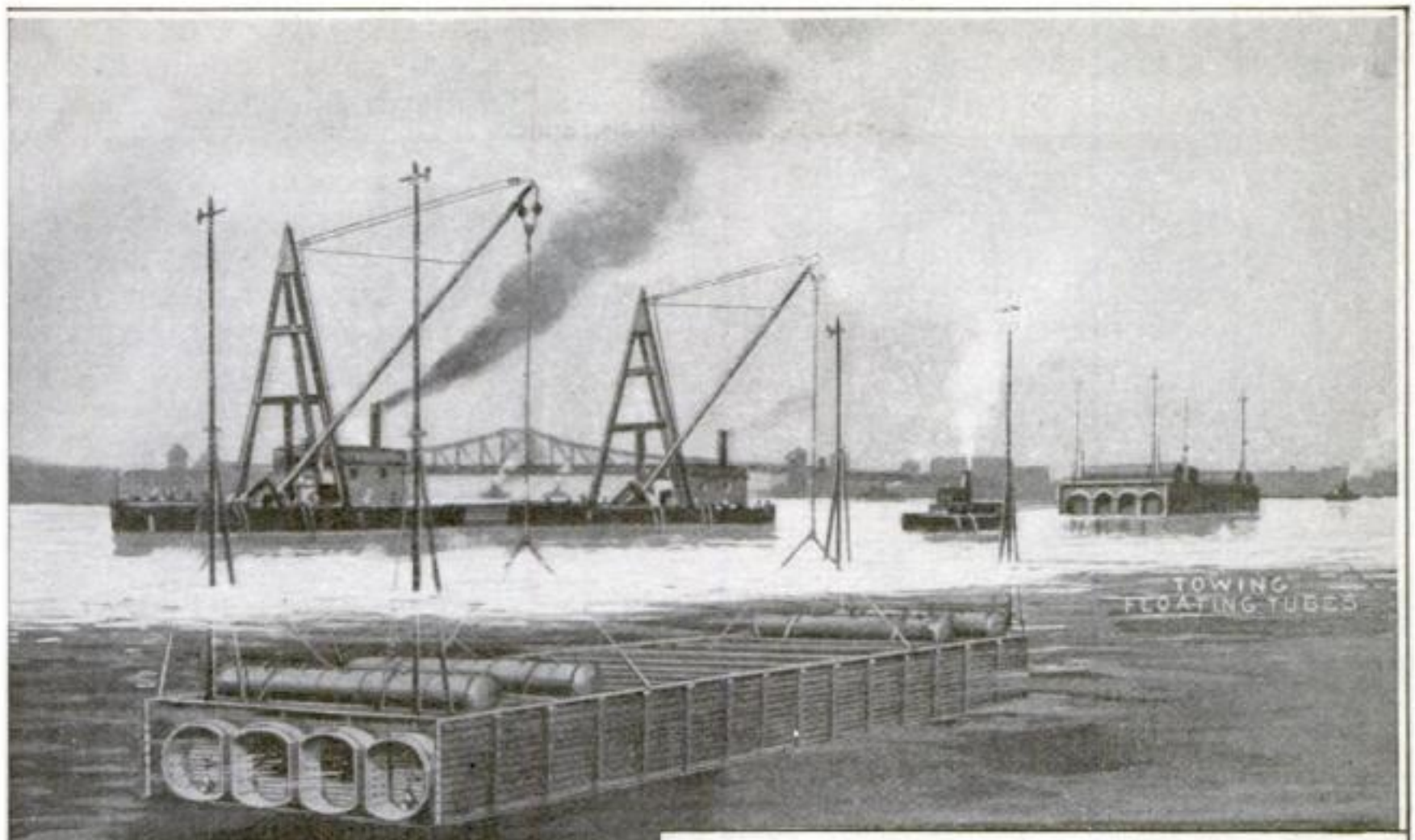
These cylinders, of light steel plate, were divided into three compartments (a small center one about fifteen feet long and two end ones about twenty-six feet long). Each compartment was fitted with separate valves for the admission of water and for the application of air pressure by which the water could be removed entirely from the cylinders, or from any compartment, or adjusted to any desired refinement. The cylinders had a combined floating effect seventy-six tons greater than the structure when submerged. Hence it was necessary to let in but nineteen tons of water to each of the cylinders to overcome their tendency to float. With the buoyancy-cylinders in place and four long steel location masts erected and carefully plumbed so that they were exactly over the center line at each end of the outer tubes, the section was ready to be towed into position. Approaching the site, the scene presented was essentially that shown at the extreme right in the illustration.

Filling the Tubes with Water to Sink Them

In order to fill the outside tubes with water (the first operation in lowering a section), twelve-inch submerged valves in each of the end bulkheads were opened simultaneously. With the excess floating effect of the buoyancy cylinders in mind, it will be appreciated that it was relatively unimportant how fast the tubes filled with water as long as they maintained an even keel. Slowly the section settled, as it filled with water, until it became submerged. Gradually it transferred its weight to the buoyancy cylinders and pulled them down into the water until only about two feet six inches of the cylinders were visible, a condition which followed shortly after that shown in the insert at the lower right-hand corner of the double-page illustration. Workmen standing upon

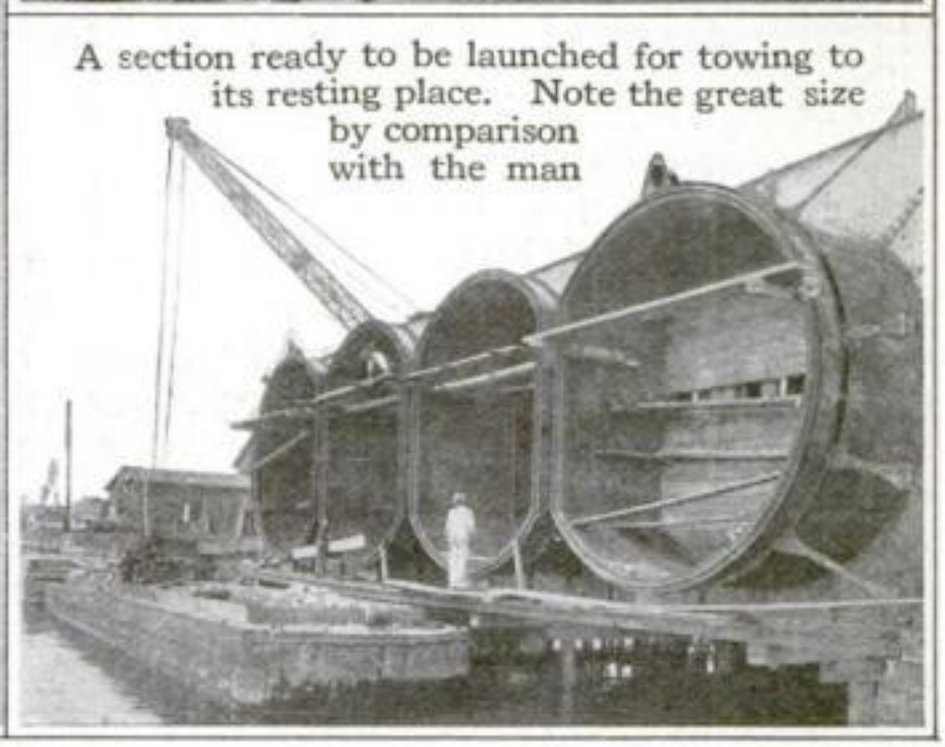


The four tubes of the new subway under the Harlem river in New York city are being put in place by floating them to a point above their destined position. The sections are then released from the barges which are carrying them half submerged and are dropped into place. Once in the trench which has been dug in the river bottom, concrete is sent down through



The great tunnel sections seem to float in the water as easily as though they were of wood. Four sections, when floated to their positions, weighed seven hundred and fifty tons

A section ready to be launched for towing to its resting place. Note the great size by comparison with the man



pipes to embed the tube sections solidly in the rock and to join the sections, one to the other. The work is done by divers where the elaborate mechanical system is inadequate, and at last compressed air forces the water out and the final joining is completed. This method requires less time and is less expensive than the use of a driving-shield

each of the cylinders next simultaneously turned wheels which opened a three-inch water-valve in the bottom of the center compartment of each cyliner and by carefully observing the rate at which the cylinders became submerged and testing the subsequent load transferred to the derrick, the nineteen tons of water to overcome the buoyancy was admitted, filling the center compartment to about one-half its capacity. Then just enough more was let in to hold the section in position when lowered, against the action of the tidal currents in the river. This total excess load never amounted to more than a few tons, which the derricks readily sustained. The section was lowered, until one of the diaphragms at or near each end, rested upon temporary timber frames, in the shape of an inverted "U." By means of the location cables attached to the ends and sides, the section could be shifted north or south, east or west until the masts (which projected about ten feet above the water) indicated that the structure was in proper position. The control over this large steel structure was very complete; the section could be raised or lowered, shifted at will, or could even have been brought to the surface again if conditions had made it necessary.

How the Sunk Tubes Were Joined

Each section after the first, had a positive anchorage to the section previously placed; the ends were brought into perfect alinement by means of steel pins mounted on the end of one section, and guided into tapered holes in castings mounted in the same relative position on the other section. As the two sections were drawn together, the pins were started into the tapered holes and served to guide the ends to a positive junction, then a diver bolted them together. The complete operation from the time of opening the valves to admit the water to fill the tubes, to their final anchoring, required but three hours.

As soon as a section was placed, preparations were made to deposit the encasing concrete, the weight of which was necessary to keep the tubes from coming to the surface when their buoyancy would be restored in the unwatering, and the strength of which concrete, together with the reinforcing effect and waterproofing qualities of the steelwork, was to provide a safe working-chamber for the completion of the subway structure. The section, as far as described, might be considered to be a large box sunk in the bottom of the river, without top or bottom but having sides and ends, and divided by the diaphragms into a series of pockets which could be filled with concrete in any convenient order.

Pouring Concrete Through Pipes

The tubes, being surrounded with water, the problem resolved itself into displacing this water with concrete and without the loss of the cement which would occur in dropping the concrete through even a much less depth of water. This was accomplished by what is technically known as the "tremie" method of depositing which involves the use of long pipes which are kept nearly full of concrete and which are raised a little as the concrete is poured in at the top. A nearly continuous flow is maintained. The concrete gradually displaces the water but does not mix with it. Each pocket required an average of twelve hours for its completion by this method.

When all of the pockets had been filled, except those over which the buoyancy cylinders had been placed, these cylinders having performed their functions, were disconnected by forcing the water out of them; they floated to the surface there to be reclaimed for use on the next section.

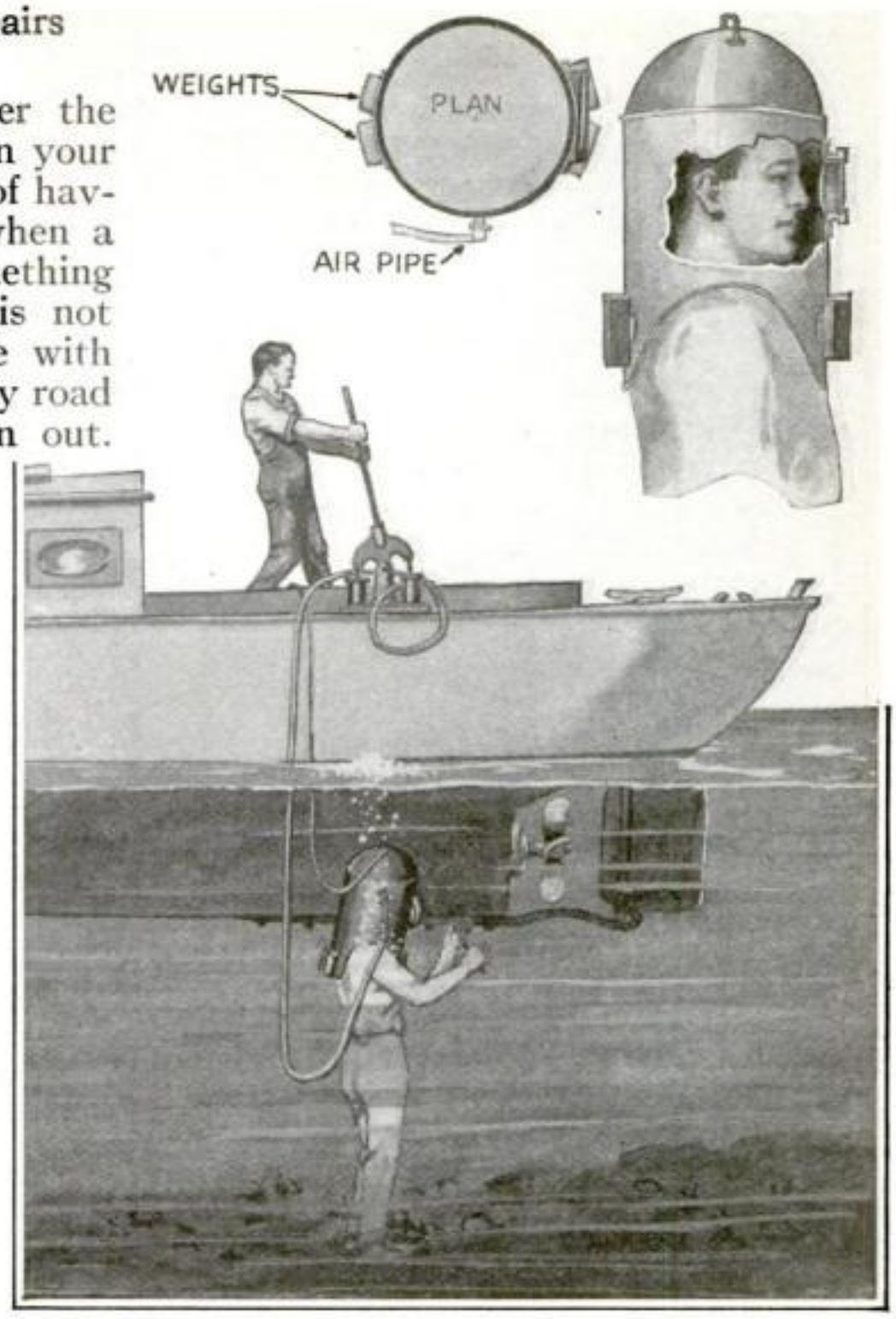
With all of the sections in place and encased and with the extreme ends of the series closed by the heavy wooden bulkheads previously mentioned, four small steel shafts or wells attached to the tubes before sinking, were opened and the water pumped out. It was then possible to get inside of these submerged passages beneath the river, assemble the concrete forms and place the lining, thus completing the structure. There were no leaks in the tubes except where some of the bolts in the interior walls had not been tightened sufficiently, and by tightening these bolts, the finished work was, figuratively speaking, "dry as a bone."

Making Your Own Boat Repairs Under Water

WERE you ever gliding over the smooth surface of a lake in your motor-boat with the satisfaction of having a perfectly working craft, when a sudden lurch told you that something had gone wrong? The feeling is not pleasant. It is only comparable with being stranded at night on a lonely road when your automobile has given out. In an automobile you are better off than in the motor-boat. Every kind of device has been thought of to help out the automobilist, but the yachtsman has been neglected. At last a device has been invented for the lover of boating which obviates the necessity even of towing the boat ashore to find out what damage has been sustained and what repairs are necessary.

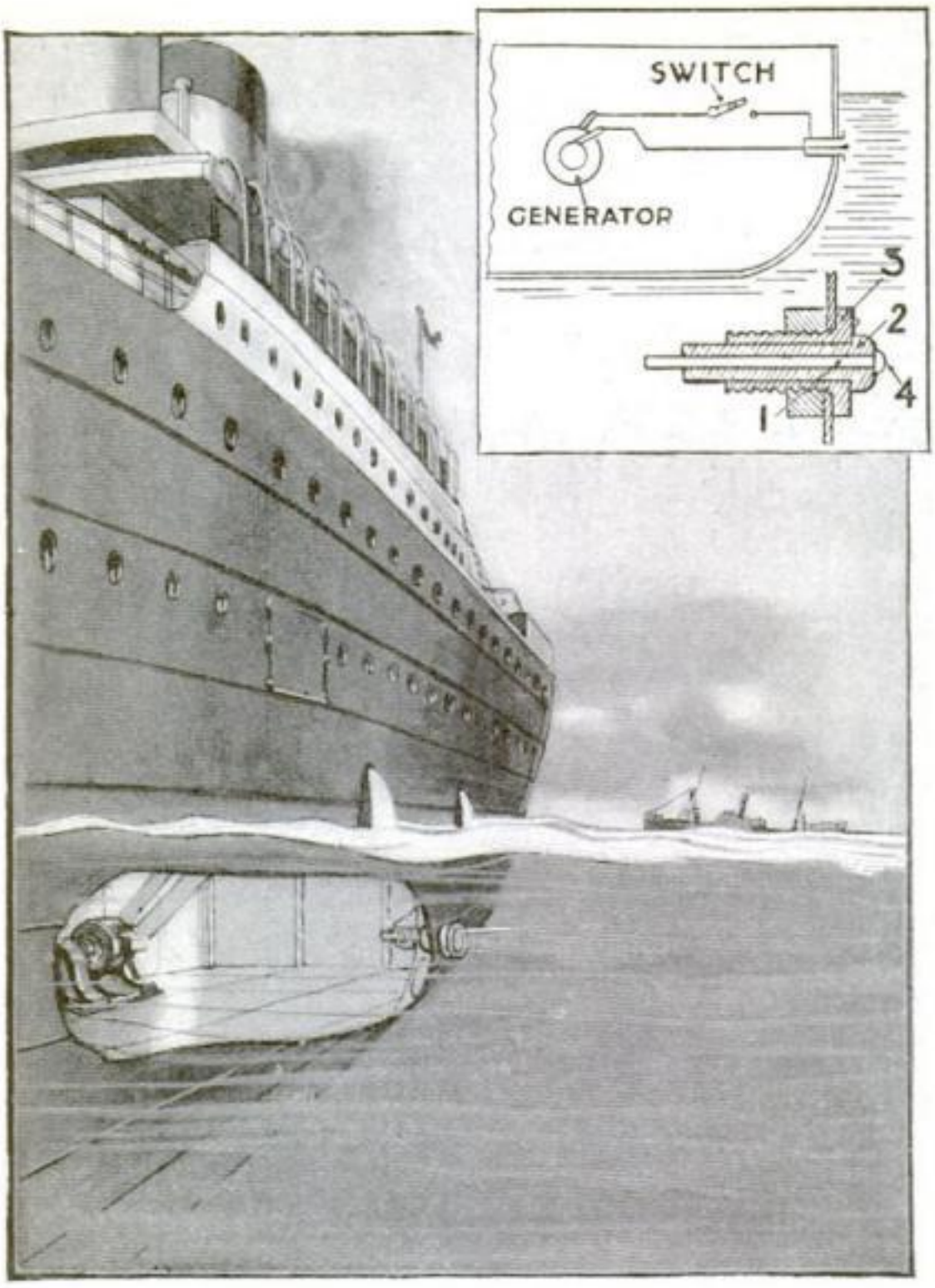
The inventor of the device once found himself adrift with a broken rudder. Down through the clear water he could see the broken part. He had the proper tools for repairing it, but there was no way of reaching it. If only he could get down under the boat! The idea of a diving-helmet occurred to him then and there. After a series of experiments, the actual thing was produced.

This diving-helmet is of metal. Its lower edge fits snugly over the shoulders. Four adjustable weights, two in



You do not have to be an experienced diver to use this hood. A metal helmet, bearing four weights, rests on the shoulders, and a hand-pump furnishes fresh air. All sorts of emergency repairs can be made under water with this device

In the middle picture is shown Rex Beach, the author, just emerging from the water after testing the diving-helmet. The other two illustrations were made off the Florida Keys by photographing under water. In case of accident, the diver can rise to the surface immediately by simply removing the hood



A submarine signaling apparatus that makes sounds under water by vaporizing the water and thus causing waves which transmit the sound

front and two in back, are fastened in place by metal strips. These weights overcome the buoyancy of the air in the hood and the natural buoyancy of the person wearing it. The buoyancy of the air in the hood tends to hold it in an upright position. Since the weights are suspended below the center of buoyancy of the body (which is in the chest), the shoulders are held firmly in the curved lower edge of the helmet.

Fresh air is supplied to the diver by means of a single tube which leads to a small hand-pump in the boat. The pressure of the pumped air not only prevents the water from entering the hood, but keeps a fresh supply passing through at all times. Since there is no suit to inflate, pressure of the air in the helmet is always sufficient to equalize the water pressure at the depth the diver is working and no more. As in the case of the regulation diving-suit, the amount of air is regulated by signals, but should any accident happen at the source of air, the diver simply lifts the helmet off his shoulders and quickly floats to the surface, an utter impossibility in the regulation suit.

A small glass window enables the diver to see the damaged part, in shallow water. With this simple appliance, a rope tangled in the propeller, a broken blade, a jammed rudder or hull punctures can be readily taken care of.

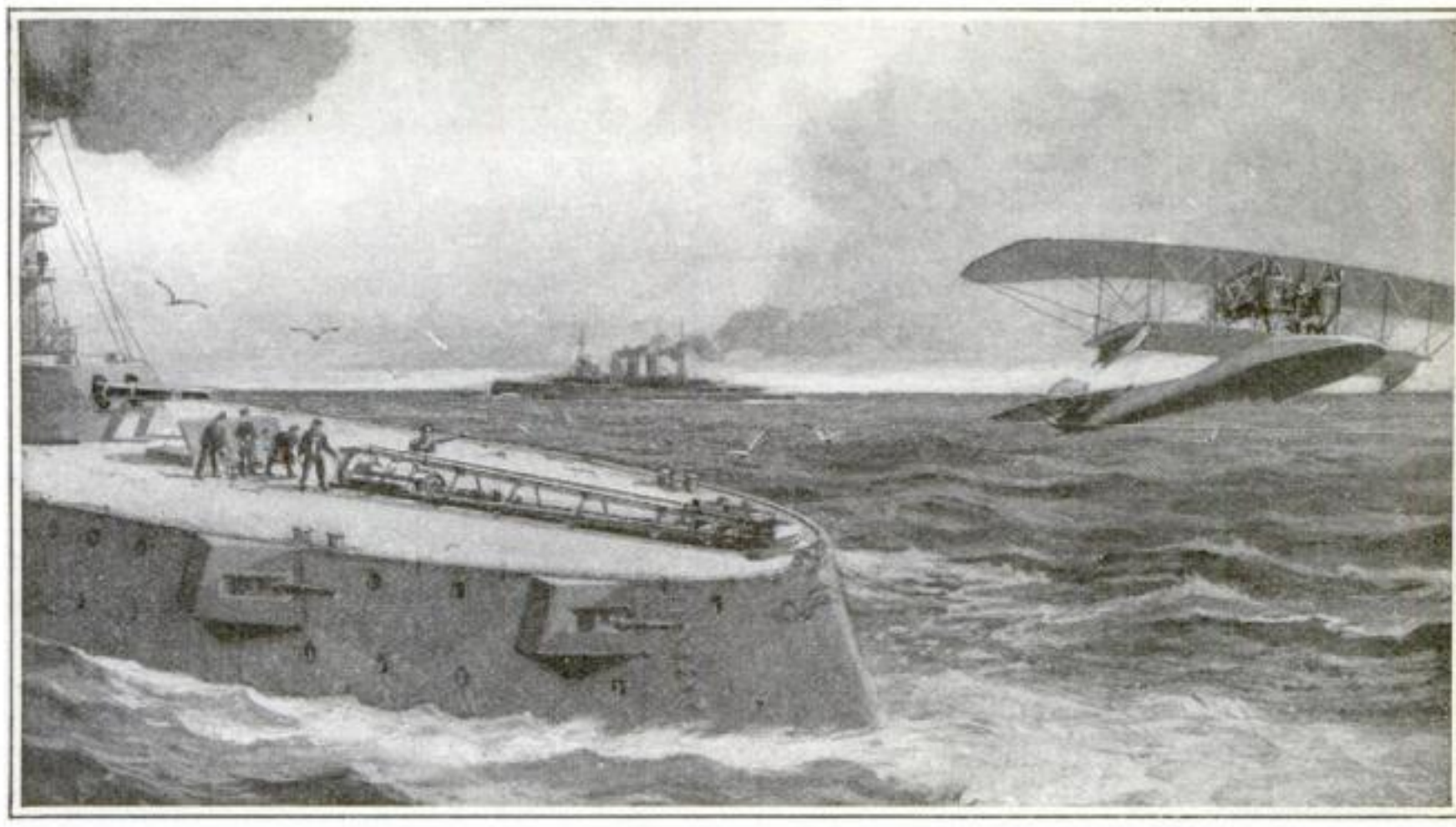
The accompanying illustrations were made by photographing the diver in twenty feet of water at Sea Gardens along the Florida Keys.

Submarine Signaling with Sound Waves

AN improvement has been made upon the usual bell and striker for use in submarine signaling. By means of a new device, recently patented by Theodore Bodde, waves may be transmitted much greater distances than heretofore. Also, the frequency or pitch of the sound waves is entirely under control. Another advantage lies in the relatively small size of the apparatus.

An electrode 1, centrally placed in the bushing 2, passes through the hull of the boat, the collar 3 holding the bushing in position. The electrode terminates externally in a sparking-knob 4. The bushing and the electrode are connected with the two brushes of an alternating current generator. A switch is inserted between one brush and the bushing for interrupting the circuit.

When the circuit is closed, the alternating current which is made to flow from the knob 4 to the collar 3, vaporizes some of the surrounding water. A powerful strain is exerted on the water, resulting in strong impulses being sent out. Signaling may be accomplished by opening and closing the switch.



By means of a trigger which moves but forty inches, an aeroplane can be catapulted into the air with a velocity equivalent to a run of forty feet on the ground. This new invention advances the use of aeroplanes at sea far beyond anything yet achieved

Catapulting Seaplanes from Battleships

A FEW years ago, when the thought of using aeroplanes in connection with battleships occurred to naval officers, the problem of launching was solved in a crude way by means of temporary inclined platforms built on the deck. Apart from the military objection to such a structure, the weather conditions had to be decidedly favorable in order to insure a successful start for a flight. At no time was it considered practicable to launch the flying machine while the ship was in motion. The machine ran down on the platform on the regulation wheels of a land machine; they were not real seaplanes.

It was apparent that the hydroaeroplane or seaplane would have to be carried temporarily upon a car or truck from which it could be detached at the right moment and allowed to rise of its own impulse by reason of the supporting pressure of the air due to the speed acquired in a short run. It was also clear that the car would have to be quickly accelerated to full speed within a run of something like forty feet. This rapidly gathered headway had to be insured without jerks or jars. To this end Captain Washington I. Chambers of our navy has devised a compressed-air catapult, the compressed air operating a piston which, in its turn, actuates a wire rope traveling over pulleys. A movement of but forty inches on the part of the piston is multiplied so as to draw the car forward forty feet.

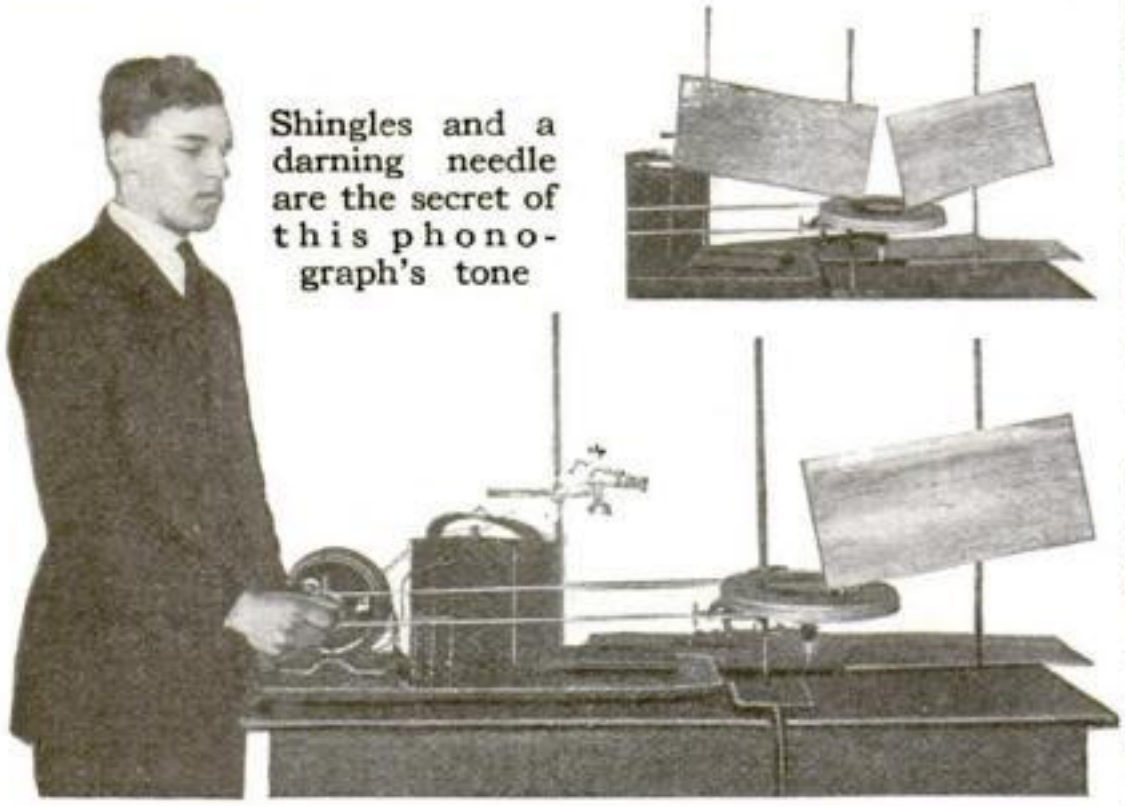
To-day, the catapult has been so far perfected by the Bureau of Construction and Repair of the Navy Department that it has become a permanent feature aboard the aviation ship U. S. S. *North Carolina*. It is now possible to launch in flight the service seaplanes while the cruiser is steaming along at fair speed.

The seaplane's motor is set going before the catapulting process is started. In fact, the pilot does not give the signal for launching until his engine is working just right. The impulse air for working the piston is drawn right from the torpedo air-supply system, and the working pressure is something like three hundred pounds to the square inch. By means of a cleverly designed valve the air is admitted progressively to the cylinder, and in this way the desired maximum speed is reached from zero without shock.

In the future, our navy, when hundreds of miles from shore, will be able to send its seaplanes skyward with measurable indifference to the weather.

Burning Cars to Make Money

AFTER having carefully estimated the value of the wood in discarded railroad cars, balancing it against the cost of the labor necessary in retrieving it, the Pennsylvania Railroad came to the conclusion that it would be far more profitable to burn the old wooden cars entirely; then recover and sell the scrap iron remaining. By following this method of economy not only with cast-off cars, but with scrap material of all descriptions, the railroad company saved $2,000,000 in one year. Waste paper alone sold for $19,211, while old wheels, metals and wrought iron yielded more than $780,000.



Shingles and a darning needle are the secret of this phonograph's tone

The Shingle-Phonograph

THE accompanying illustration shows a phonograph recently constructed by Harvey Smith, a student in the West Allis High School, West Allis, Wisconsin.

The reproducing part of the phonograph is nothing more pretentious than an ordinary shingle, with the point of a darning-needle securely fastened in one corner. A steel knitting-needle, clamped in a laboratory ring-stand, is thrust through a hole in the shingle to support it as it is carried over the record. The record is mounted upon a wooden turn-table constructed as follows:

A disk made of three-quarter-inch wood, with a groove in the edge is mounted on the hub and axle of an old bicycle-wheel, so that it can turn easily. This is connected with an ordinary battery-motor by means of a cord-belt. Pressure of the thumb and finger on the shaft of the motor regulates the speed of the disk. Records can be played backward simply by twisting the belt. The small illustration shows how two shingles may be used at the same time to play a duet on the same record. In like manner three or four shingles may be used.

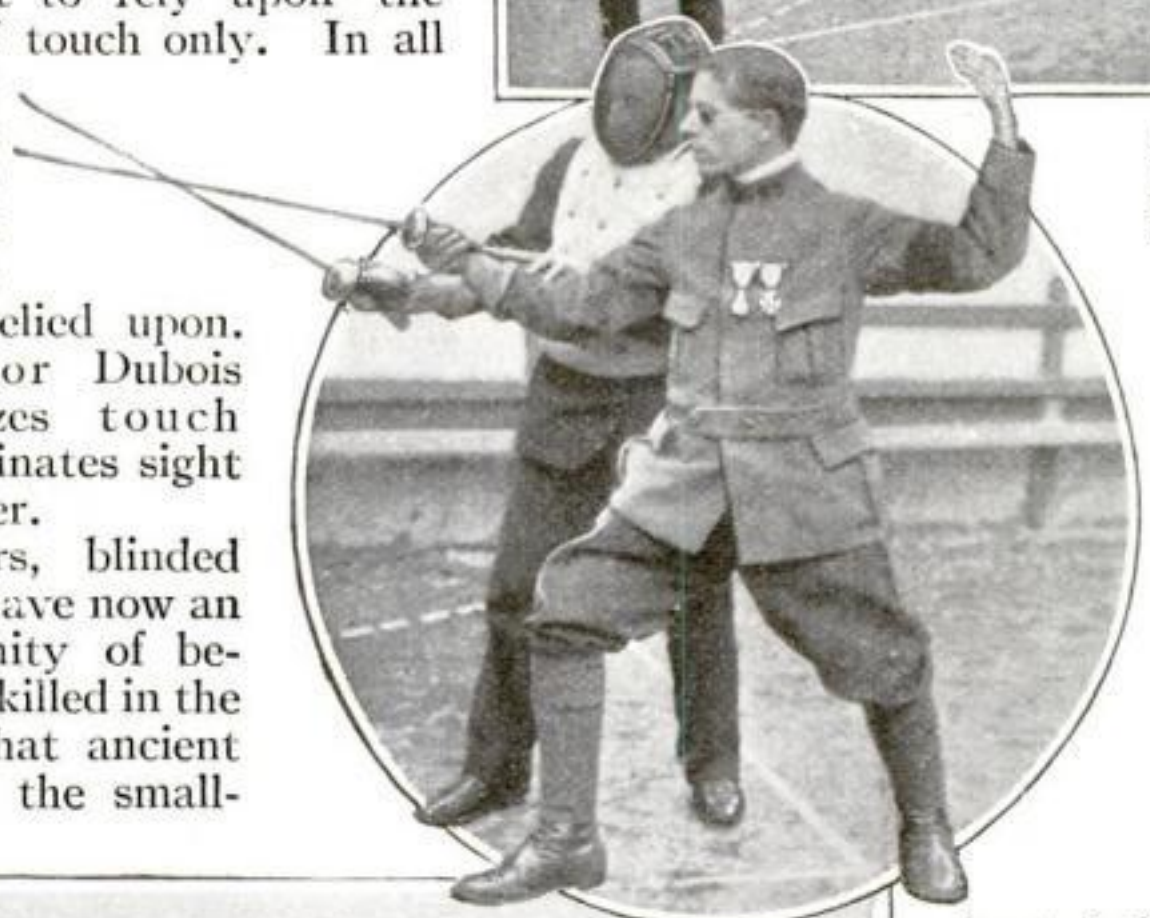
By burning its old wooden cars a railroad company saves $2,000,000 a year in labor formerly spent to repair the cars. Before setting fire to the cars, all usable fixtures are removed. After the fire, the remaining scrap iron is sold

Teaching Blind Men to Fence

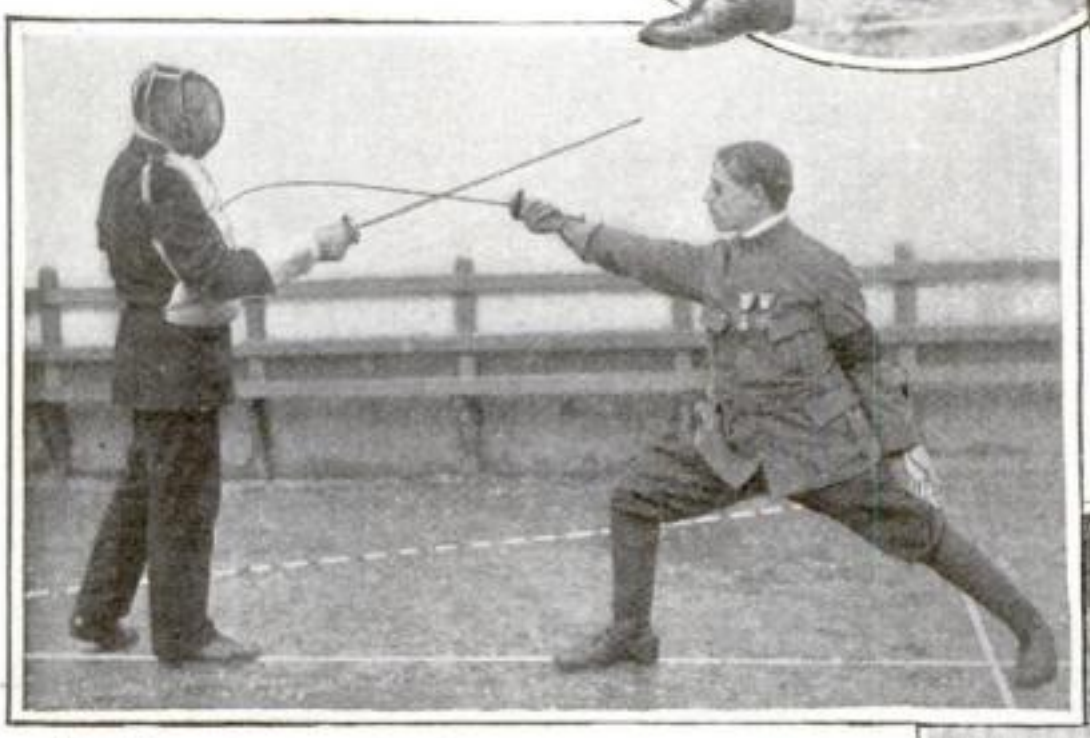
IN FRANCE, the only country where fencing can be said to flourish, a new system for teaching the use of the foil to blind men has sprung up. Its originator, Georges Dubois, has a method whereby the student is taught to rely upon the sense of touch only. In all fencing methods the sense of sight is not wholly relied upon. Professor Dubois emphasizes touch and eliminates sight altogether.

Soldiers, blinded in war, have now an opportunity of becoming skilled in the use of that ancient weapon, the small-sword. A blind man's one advantage is his ability to concentrate his attention without being distracted by seeing the action of others. This is of great value in modern fencing where a single "touch" anywhere on the body means that the bout is over. Intense alertness is requisite from the moment the fencer puts himself "on guard."

The white strips on the ground enable the student to assume his position

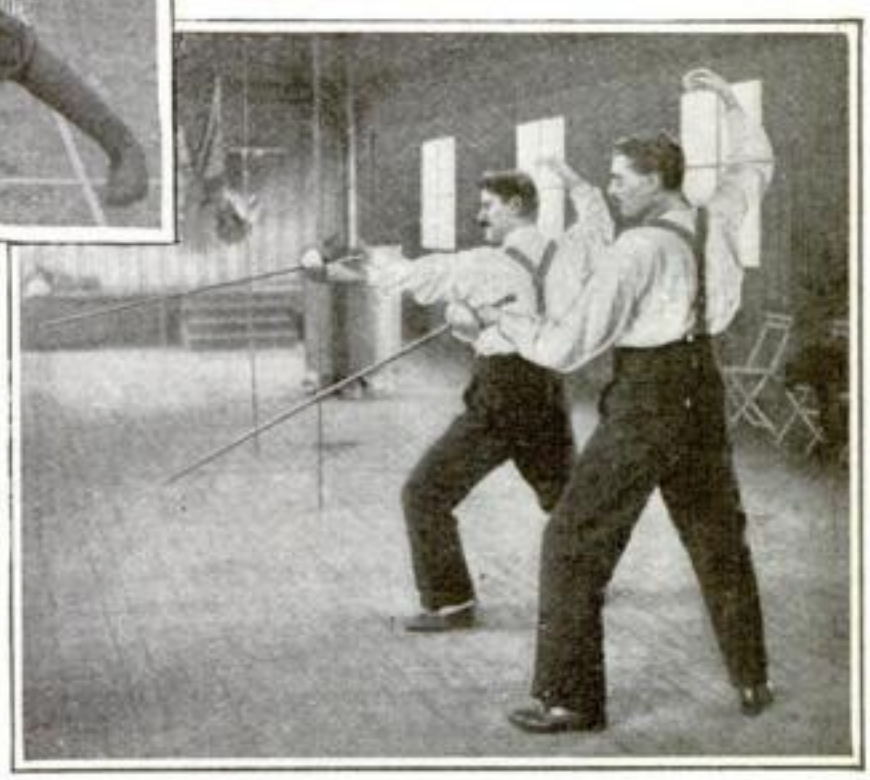


In the circle is shown Professor Dubois placing the pommel, or end of the handle, against the student's wrist. If the pommel is in the center of the wrist, the blade is in line with the arm. The blind students practice "binding," by twisting their blades over their opponent's and thrusting at the same time. This play is mainly for thrusting under the shoulder, accomplished by twisting the foil.



Making a successful thrust is the test of a blind man's training

Blind students are taught the feeling of an opponent's sword by means of iron rods



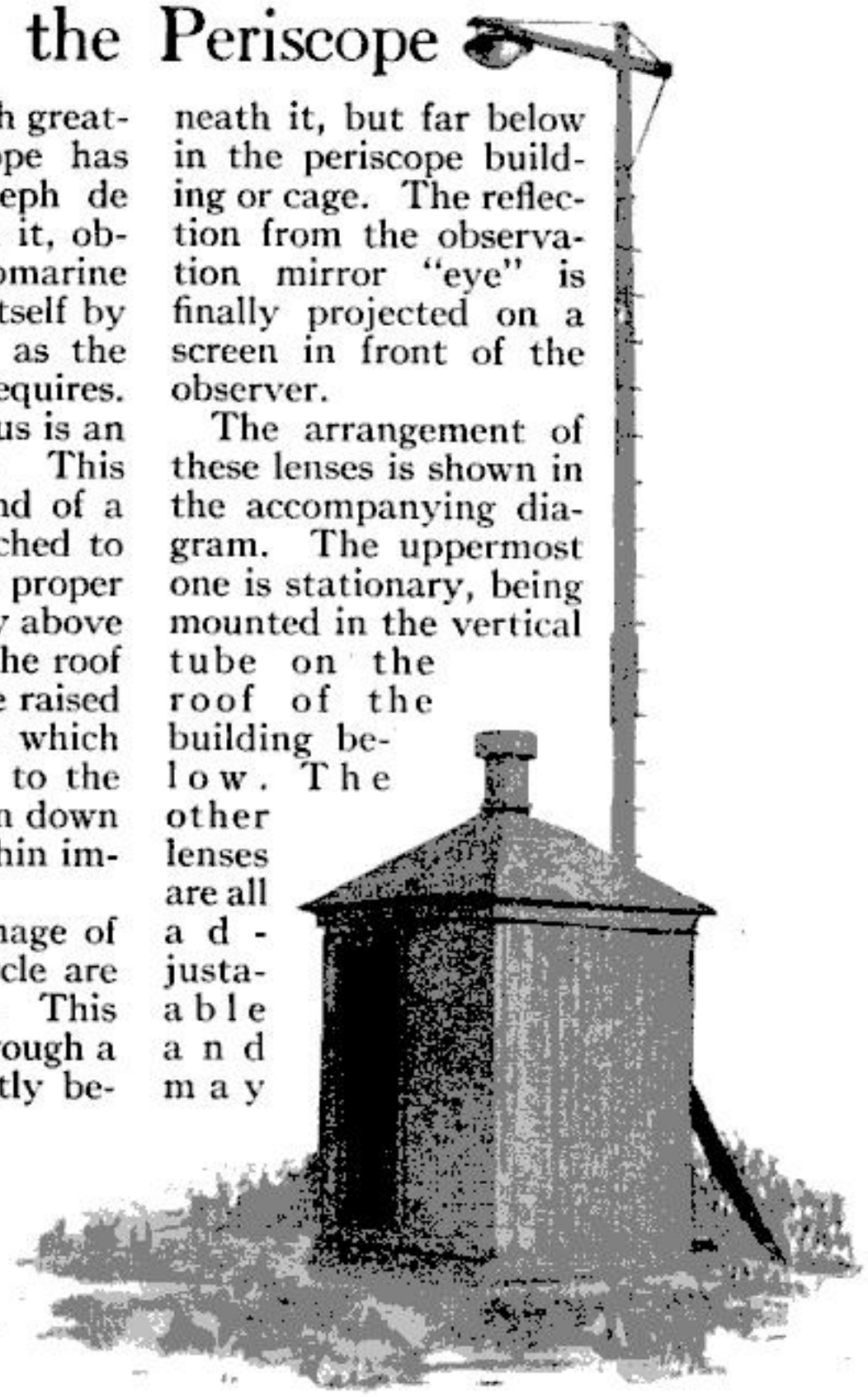
Out-Periscoping the Periscope

AN observation apparatus with greater range than the periscope has been constructed by Joseph de Falco, of Vineland, N. J. With it, observations can be made by a submarine without the vessel endangering itself by coming so close to the surface as the present submarine periscope requires.

The "eye" of the new apparatus is an inverted semi-spherical mirror. This mirror is suspended from the end of a horizontal rod. The rod is attached to an adjustable mast, and is of the proper length to bring the mirror directly above a vertical, chimney-like tube in the roof of the house. The "eye" may be raised or lowered by means of a rope which passes up over pulleys attached to the horizontal arm and mast and then down into the hut where the end is within immediate reach of the observer.

In making observations, an image of all objects within a complete circle are reflected by the eye-like mirror. This image is magnified as it passes through a series of magnifying lenses directly beneath it, but far below in the periscope building or cage. The reflection from the observation mirror "eye" is finally projected on a screen in front of the observer.

The arrangement of these lenses is shown in the accompanying diagram. The uppermost one is stationary, being mounted in the vertical tube on the roof of the building below. The other lenses are all adjustable and may be regulated according to the height of the mirror outside, the object being, of course, to focus the picture on the observation screen below.



The innocent-looking hut appears to be a shed with an electric light pole above it

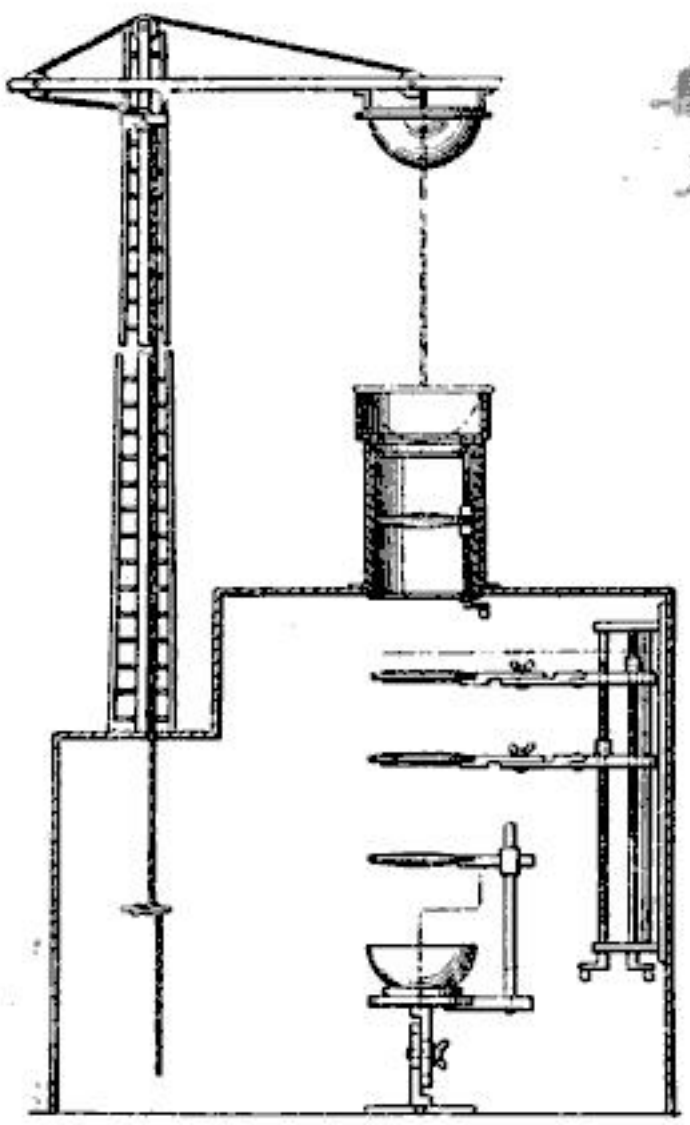


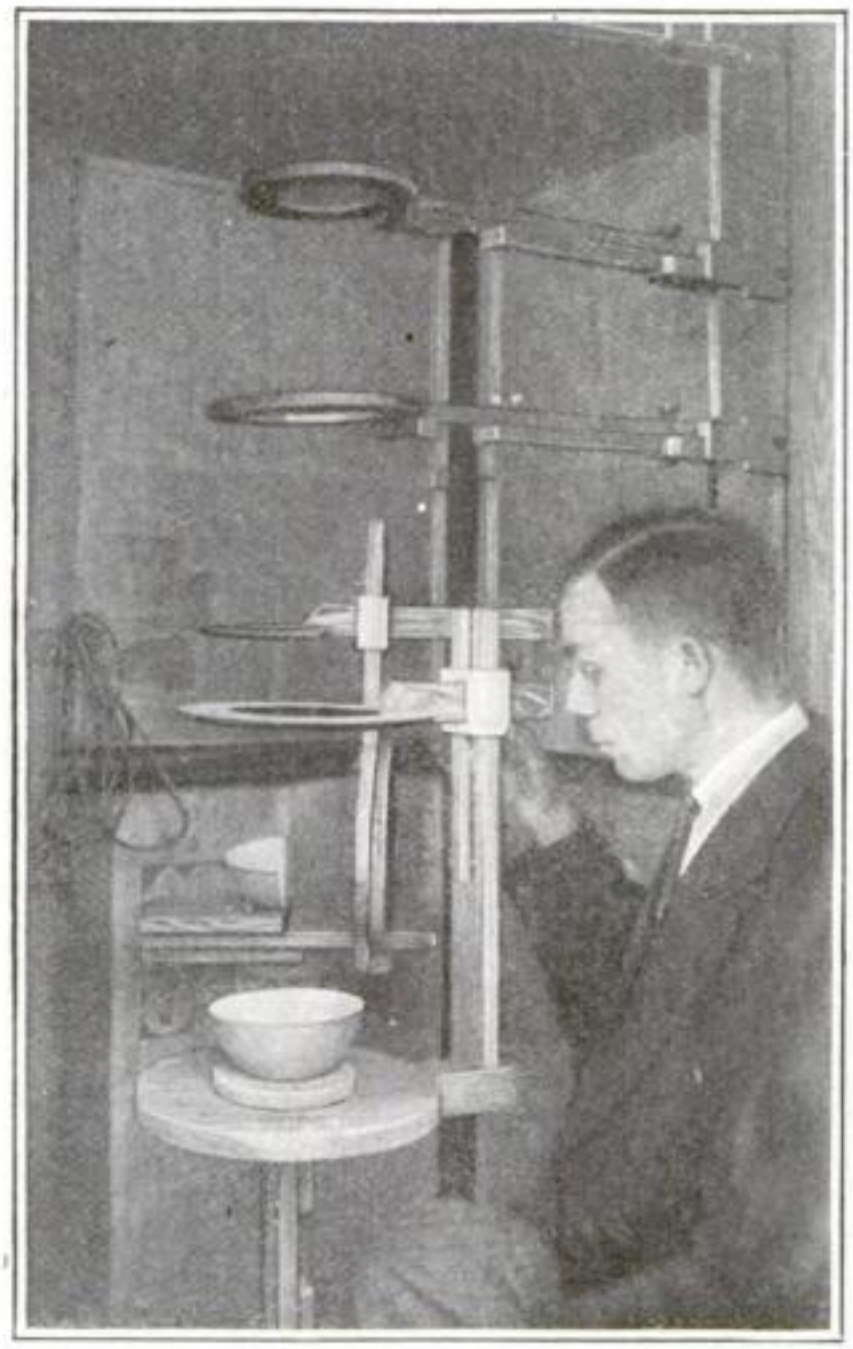
Diagram of construction of observation apparatus, showing the "eyes" and the lenses

This screen is, in reality, a semi-spherical shell with the concave surface uppermost. It is made of white enameled glass, so as to make a distinct image of the outside world. This observation apparatus rests on a table of suitable height for a man to sit comfortably and watch proceedings without incurring the risk of being seen and fired at. The picture thus obtained is in the nature of a bird's-eye view, since the mirror is located at a considerable height.

On the battle-fields of Europe a method

of taking observations is to hoist an officer to the top of an extension or telescopic mast or tower. There the view is excellent until a bullet or shell interrupts his work.

If in place of a human observer, the "eye" or semi-spherical mirror of the observation apparatus were substituted the securing of necessary observations would not be as costly to life, and the view obtained would be a more extensive one.



The observer sits safely inside the hut and watches what is going on in the semi-spherical mirror on the table

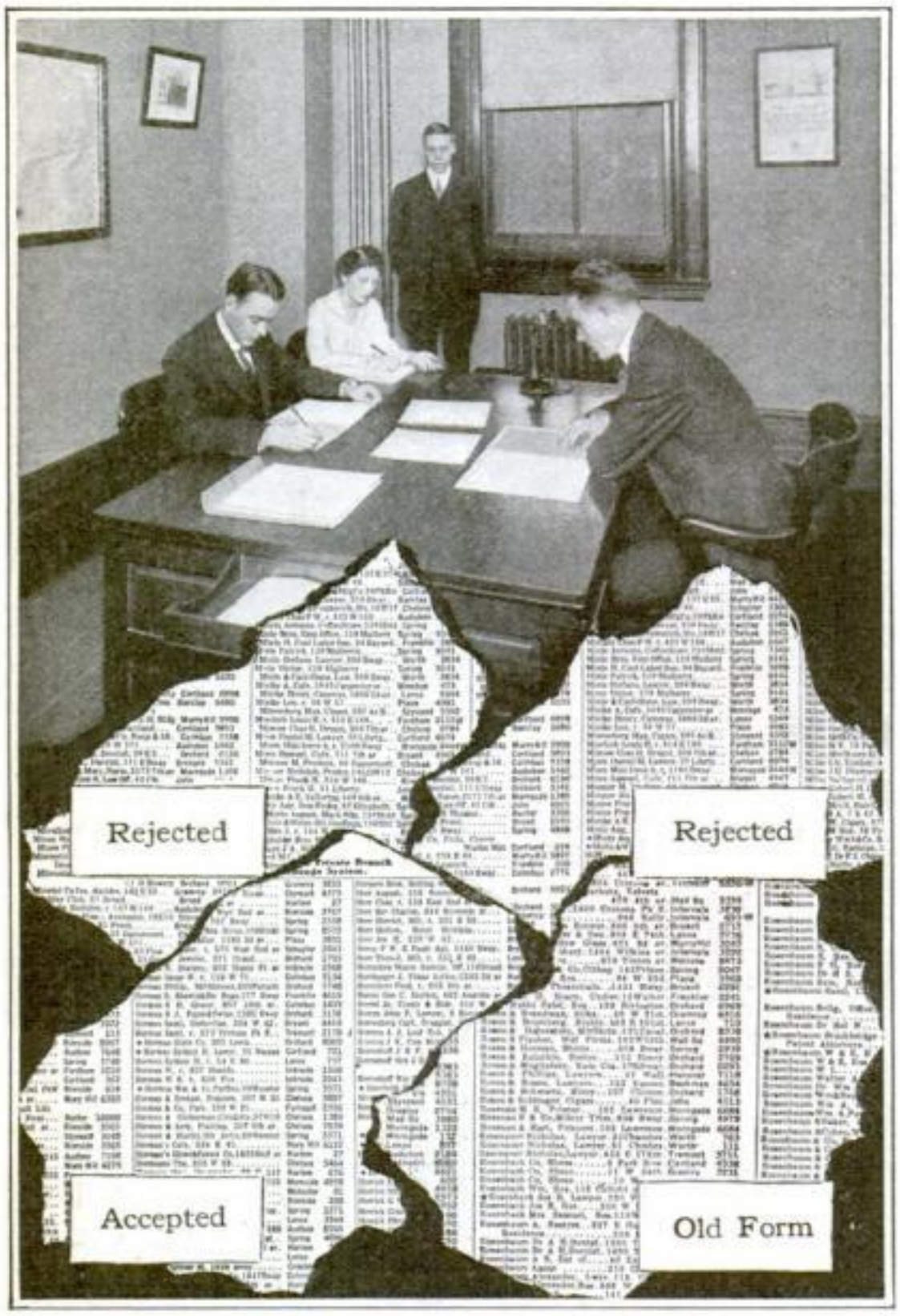
More Motion-Pictures in Color

NATURAL-color moving-pictures have so far achieved very little success, mechanical difficulties being the stumbling block which no inventors have yet been able to overcome successfully. One company has developed hand-tinting to a fairly satisfactory degree, although the results have not yet attained the necessary standard. The color effects are somewhat obvious. Another maker of colored moving-pictures placed his on the market before being commercially perfected. With this process it was necessary to run the film through the projecting machine at twice the normal speed, natural-color results being obtained by a revolving color disk which allowed red and green pictures to be flashed alternately on the screen. The same process took place when the picture was taken. The latest attempts at moving-picture color photography is suggested by an English inventor who proposes to expose alternate "frames" or pictures of a film through a shutter provided with a color filter. On one "frame" the colors in the photographed object which contain green will be registered on the next "frame;" various shades and tones of red will be separated out. When the positive film is printed from the negative strip it will be stained orange and green in alternation. Two positive films will be printed from the one negative and stained, then superposed and cemented together. Alternate frames are stained green and orange, and the two strips so arranged in assembling that when the film is ready for projection one green frame will be opposite an orange frame. The film will be run through the projection machine at normal speed, i. e., sixteen frames a second, and the resultant image on the screen, if the process works out as it is planned, will be lifelike in color. By a complication of the process, using three fundamental colors, instead of orange and green, finer gradations of color will be possible. The difficultues which beset this plan can be removed by adequate mechanical means. Coloring alternate frames red and green has not yet been successfully accomplished—at least on a commercial scale—although it probably could be done. The other difficulty is to secure positive film half the present thickness which would be sufficiently flexible and durable when two strips were cemented. The matter of superposing two film sections, so that the images exactly coincide—and this is absolutely necessary due to the immense magnification which takes place—is an important mechanical problem which must be thoroughly worked out.

Putting Speed in Telephone Directories

A SERIES of experiments were recently conducted by the New York Telephone Company to ascertain the quickness with which a telephone number could be found with the book printed in three different ways.

Dr. J. W. Baird, Director of the psychological laboratory at Clarke University, Worcester, Massachusetts, was called in to supplement the work of the telephpne men by conducting other tests, using a variety of type arrangements. Dr. Baird made nearly four thousand experiments to determine the case and speed with which the average person could find a number on pages of the directory set up in various forms. Thirty-two men and women were selected as subjects for the tests. Care was taken that these individuals should represent radically different occupations and degrees of experience in the use of the directory



Testing the speed of telephone directories. Names in the arrangement adopted were found in 9.28 seconds as against 10.36 seconds in the old arrangement

Pages with names beginning with the letters I and M and S were selected when tests showed that they varied sufficiently in difficulty to fulfill the purpose of the experiments.

Twelve pages were subjected to experiments, an I-page, an M-page, and an S-page, being printed in each of four different page arrangements and mounted on cardboard. Each page was placed in a separate "booklet." While the individual tested was looking up a number, the experimenters held stop-watches measuring the time elapsing from the opening of the booklet until the subject found and pronounced the number.

To find a telephone number in the old telephone directory, the pages of which were set in three-column measure, required an average time of 10.36 seconds. When the subscribers' names were printed in a four-column measure without indentation or leading, the finding time increased to 10.69 seconds. When the lines in the four-column page were set in "staggered" arrangement, i. e., in alternate indentation, the finding time was reduced to 10.14 seconds. When the type on the four-column page was made slightly higher and, moreover, narrower, taking eleven lines instead of twelve lines to the inch, the finding time was cut to 9.28 seconds. It was this arrangement of the page that was chosen, cutting 1.08 seconds from the 10.36 seconds required by the average subscriber to find a number in the old telephone book. This is a gain of more than ten per cent.

Converting an Automobile into an Apartment

YOU can go for an automobile tour now and carry your apartment with you in a neat-looking box-like contrivance which fits on the back of your automobile and which can be taken off or put on in fifteen minutes. The shell or case of the telescoping apartment is three feet and four inches long, as wide as the automobile, but not as high at the highest point as the automobile top. The roof of the "apartment" has a gentle slope.

There is very little left to desire in the way of an apartment if one has this sleeping, cooking and living telescope-automobile apartment

The apartment will fit on the back of your automobile and can be put on or taken off in fifteen minutes by an amateur

Into this small space are fitted a comfortable double bed in an electrically-lighted berth with a tempting bookshelf over the head of the bed; a complete cooking outfit, including a two-burner gasoline-stove; a table; a dressing-room attachment, with a shower bath equipment which includes a ten-gallon can and an attachment to the exhaust for heating water; storage room for a week's supply of food and linen; a dressing-table; a writing-desk; and other comforts to be had at home.

The automobile-telescope apartment is the invention of Gustav de Britteville of San Francisco, who uses it on business tours into the country.

How To Make Spirit Photographs

PRINT from ordinary negatives in the usual manner on printing-out paper, then fix the prints in a solution of 1 oz. hyposulphite of soda and 8 ozs. of water, and wash them thoroughly. While still wet, immerse them in a saturated solution of bichloride of mercury until the image disappears; then wash thoroughly. Be very careful, as bichloride is very poisonous. Soak some clean blotting-paper in the hyposulphite of soda solution and allow it to dry.

To cause the spirit photograph to appear, cut a piece of blotting-paper the same size as the prepared print, and moisten it; then hold the apparently blank piece of paper in contact with it. The photograph will come out gradualy-clear and plain, and if washed thorougl hly will be permanent.

Making Money Out of Waste Land With a Stream of Water

AS Henry Ford was laughed at when he claimed he would make a successful automobile, so Harlan K. Whitney, a civil engineer, caused much merriment when about two years ago he bought twenty acres of the most useless land on the outskirts of Battle Creek, Mich.

The new residence addition of Battle Creek, Mich., which was formerly a waste of marshes and ugly hills

The property was about evenly divided between rolling hills and squashy marshes. To-day the hills have been dumped into the marshes and leveled off, and soon Mr. Whitney will open his new addition of six blocks, which are less than three quarters of a mile from the business district, and only a block from a street-car line.

It is doubtful whether the power of hydraulics has ever before been used in the State of Michigan for this purpose. One hundred and twenty-five thousand yards of earth have been washed away, and about twenty acres graded. Some hills were twenty-five feet high.

The apparatus used was simple—so simple in fact, that it caused about as much ridicule as the suggestion that the land could be reclaimed. Two two-inch streams from an eight-inch well were pumped with a two-stage centrifugal pump. The water was carried sometimes as far as six hundred feet, sheet-iron sluices conveying away the used liquid with the sand and gravel driven before it. For a long time the water was turned back into the well, allowed to settle, then pumped over again.

His application of hydraulic mining principles to waste real estate is bound to change Mr. Whitney from an engineer of moderate means to a land owner of wealth. There will be at least one hundred lots in a most desirable location, whose total value should run close to one hundred thousand dollars. The cost was only nominal.

The reclaiming of many acres of useless land has been effected in many American cities, notably Washington and New York, and in many ways; but the use of hydraulic power for that purpose is an innovation.

How the work was done. The hills were washed away with water which carried the mud formed down into the marshes

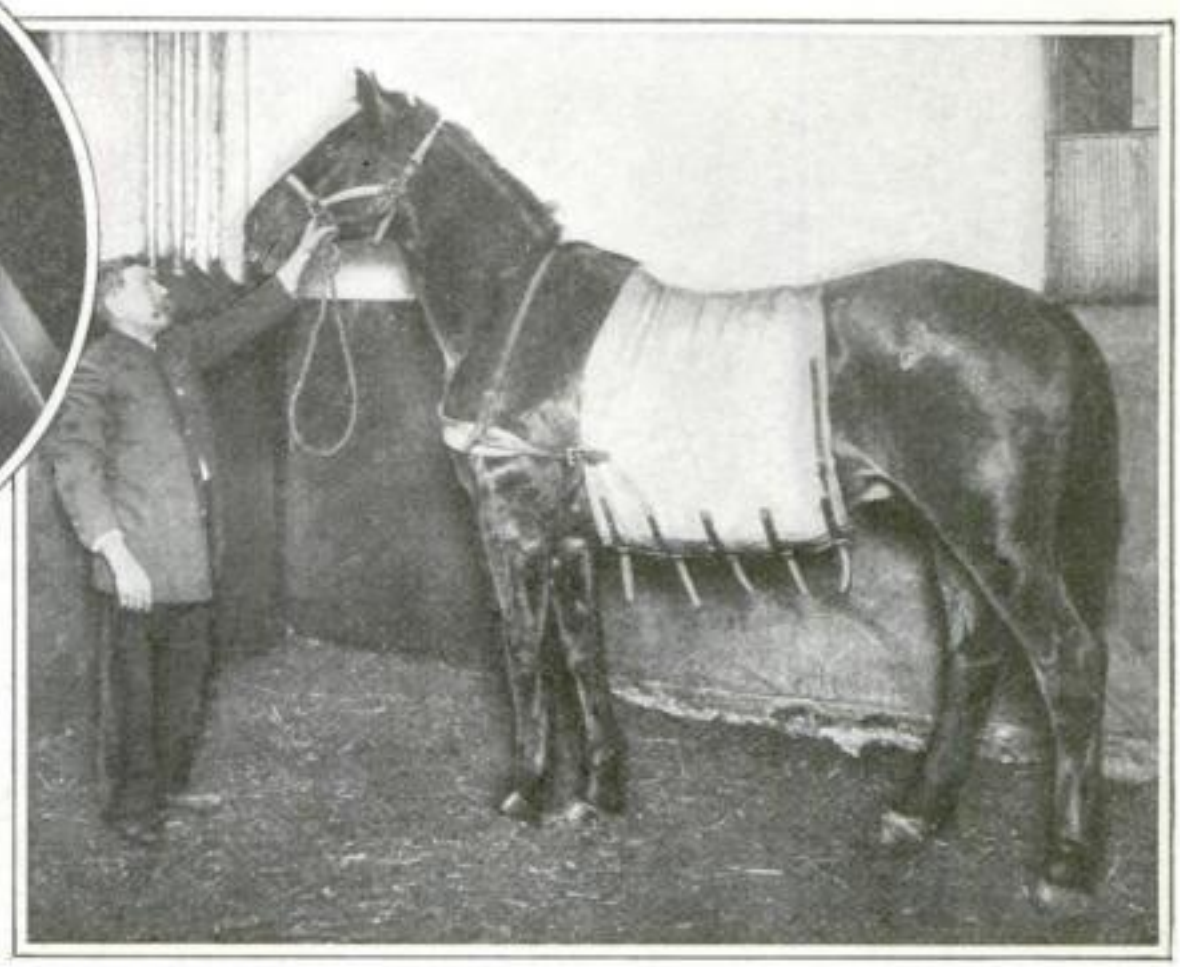
Purifying Iron in a Vacuum

AN entirely new method of producing pure iron is reported to have been discovered by Trygve Yensen, an assistant in the engineering experiment station at the University of Illinois. This discovery was made during an investigation of the magnetic properties of iron and iron alloys. His method consists in melting electrically refined iron in a vacuum, which reduces the impurities far below any point which had been reached by any previous investigator. The magnetic properties of this vacuum-fused iron have proved to be remarka-

The Modern "Horse Doctor" and How He Saves Money

By A. M. Jungmann

This terrier is suffering from a compound fracture of both hind legs. He fell from a fourth-story window. To the right is shown a sick horse. He developed pneumonia when a barge containing horses for the Allies was sunk in the Hudson



ONE million dollars is a fortune—at least it seems so to most of us. Yet animal surgery is saving one million dollars a year in New Orleans, a city of about three hundred and fifty thousand population. As New York has fourteen times as many inhabitants as New Orleans it is safe to assume that animal surgery means fourteen million dollars to New York every year.

"Oh, it's only a poor dumb animal!" is a wasteful expression of a wasteful thought. When the value of the poor dumb animal is considered in dollars and cents he immediately becomes important. Science has discovered that animals are worthy of attention because of themselves—or their economic value.

The good old-fashioned "hoss doctor" is disappearing and in his place we have the veterinary surgeon. The man who intends to devote his life to the health of animals is a man of scientific training who takes his profession as seriously as does the physician to human kind. You cannot hold yourself out as a veterinary surgeon any more than you can proclaim yourself a doctor or a lawyer without being one. In the Regent's Examinations veterinary science is classed with law, medicine, dentistry, etc. The United States has twenty-two veterinary colleges as against twelve ten years ago. There are between three and four hundred teachers and about three thousand pupils.

The American Society for the Prevention of Cruelty to Animals has been making an appeal for the protection and conservation of animals for years. Undoubtedly it has accomplished a great deal even when it has based its appeal on humanitarian motives. But in New Orleans, where the figures show that by adopting more efficient methods, the lives of its mules and horses are lengthened and the city is actually saving a million dollars a year, the Society has made a direct commercial appeal for the rational treatment of animals. Once the owners of large numbers of horses and mules were convinced that by better care they

could get more work out of their animals they were only too glad to coöperate in every way with the agents of the Society.

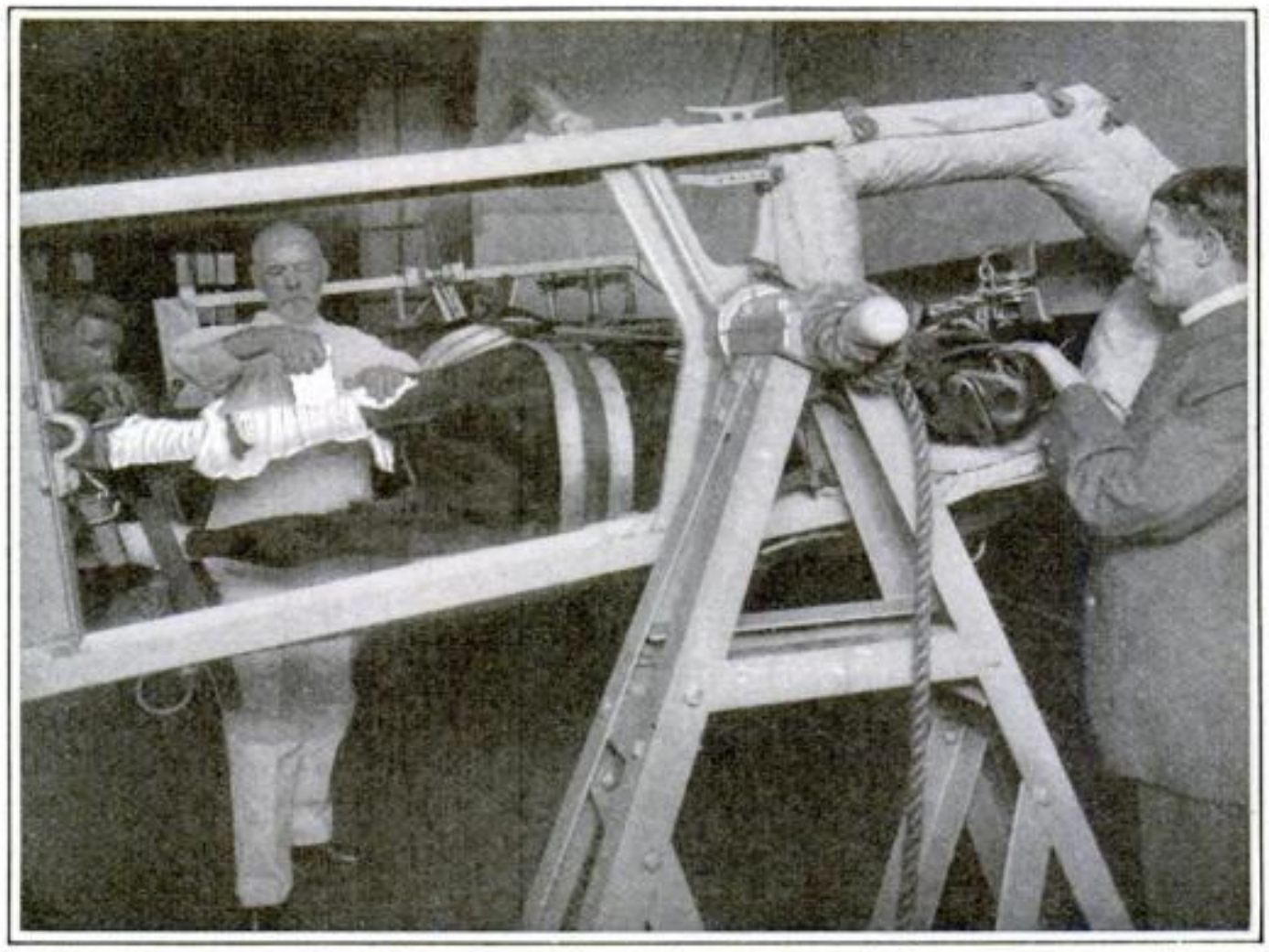
The cat miscalculated the speed of an automobile. He almost got out of the way, but a paw and his tail didn't

According to the figures published by the Department of Agriculture there are about one hundred and ninety-one million domestic animals in the United States and they are worth, roughly, six billion dollars. Is it any wonder that science has become interested in animals. There are approximately twenty-one million horses in the country, representing an investment of two billion, three hundred million dollars. The despised mule may not be so despised when you consider that he represents five hundred and sixty million dollars of our total wealth and that his kind numbers about four million five hundred thousand.

Purely as a question of national economy veterinary science should be encouraged.

The successful veterinary must be, first of all, a good diagnostician; for his patients cannot help him by describing their symptoms. On the other hand, they cannot mislead him by withholding the truth, as human patients are prone to do. Another essential is a natural sympathy for animals. This is particularly necessary; unless the doctor can gain the confidence of his animal-patient it is exceedingly difficult for him to obtain satisfactory results.

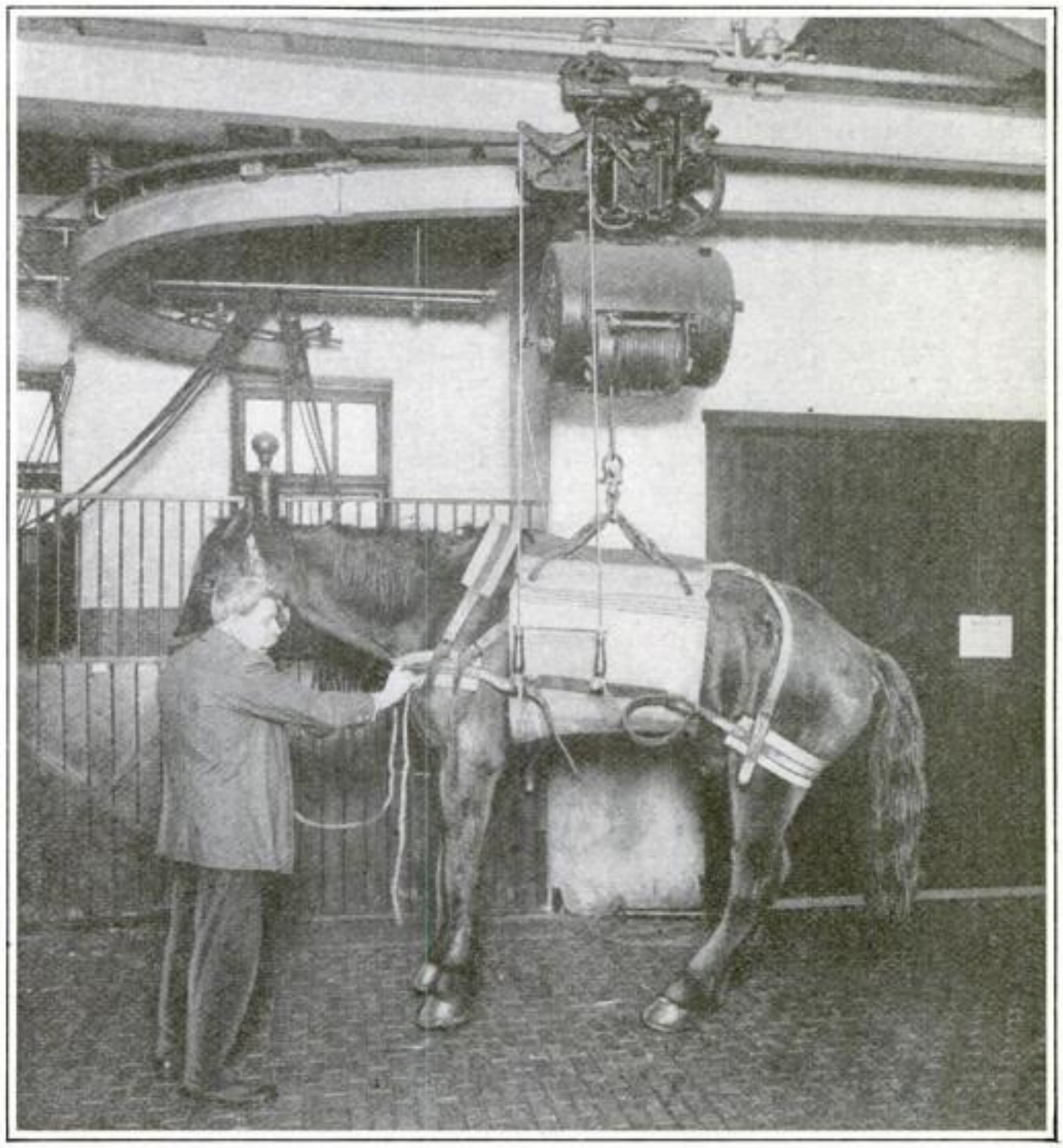
Animals are subject to many of the diseases that afflict human beings, and besides these they suffer from a number peculiar to their own species. Horses are liable to pneumonia and unless very carefully treated the disease is likely to prove fatal. One of the most serious ills to which horses are subject is known as "azoturia," meaning to the lay owner and driver spinal trouble. The horse more likely to suffer from this



The horse sustained injuries to both fore legs. A few years ago he would have had to be killed, but now, thanks to this very modern method of treating animals, he will be as good as ever in a month's time. The use of a local anaesthetic prevents the horse from feeling any pain during the operation

terrible malady than any other is the city work horse whose driver thinks he is doing the animal a kindness by overfeeding him on Saturdays, half-holidays and Sundays.

A horse suffering from azoturia will drop in the street and be unable to rise. His hind legs rendered useless, the animal loses control over his legs. Death may result in a few hours. At best the horse may liveseveraldays, suffering intensely. If a horse which has fallen in the street is hurried to a hospital he sometimes recovers. The disease is steadily increasing among city horses and is the cause of the greatest anxiety to veterinary surgeons. If horse owners would cut down their horses' feed during the days of rest or would see that the animals are exercised when full rations are fed there would be no danger. Every work day following a Saturday or Monday holiday the veterinary hospitals are crowded with unfortunate azoturia victims. Despite the progress of veterinary science, azoturia is as baffling to the veterinary to-day as it was twenty years ago.



The victim of a street accident. This horse cannot walk. So he is being conveyed from the ambulance to the operating table by means of a trolley. He is an unusually large horse but his feet just clear the floor. He is supported by the sling and a man keeps his hands on head and chest, both to reassure the horse and to prevent him from turning around

The animal hospital is conducted in much the same way as if its patients were human beings. Everything about it is sanitary to the last degree. It is divided into accident wards and contagious wards; it has perfectly equipped operating rooms; and it requires a number of ambulances. In the model animal hospital maintained by the American Society for the Prevention of Cruelty to Animals in New York city, every possible provision is made for the care and comfort of the patients. The white-tiled wards are all thoroughly sanitary. The cat and dog wards have white cages in which the patients are kept.

The Department of Health sends all rabid dogs which have bitten persons to this hospital. Here they are kept in a large ward by themselves. If, at the end of twelve days, they show no signs of rabies they may be returned to their owners; if they develop the disease they are humanely killed. When the small

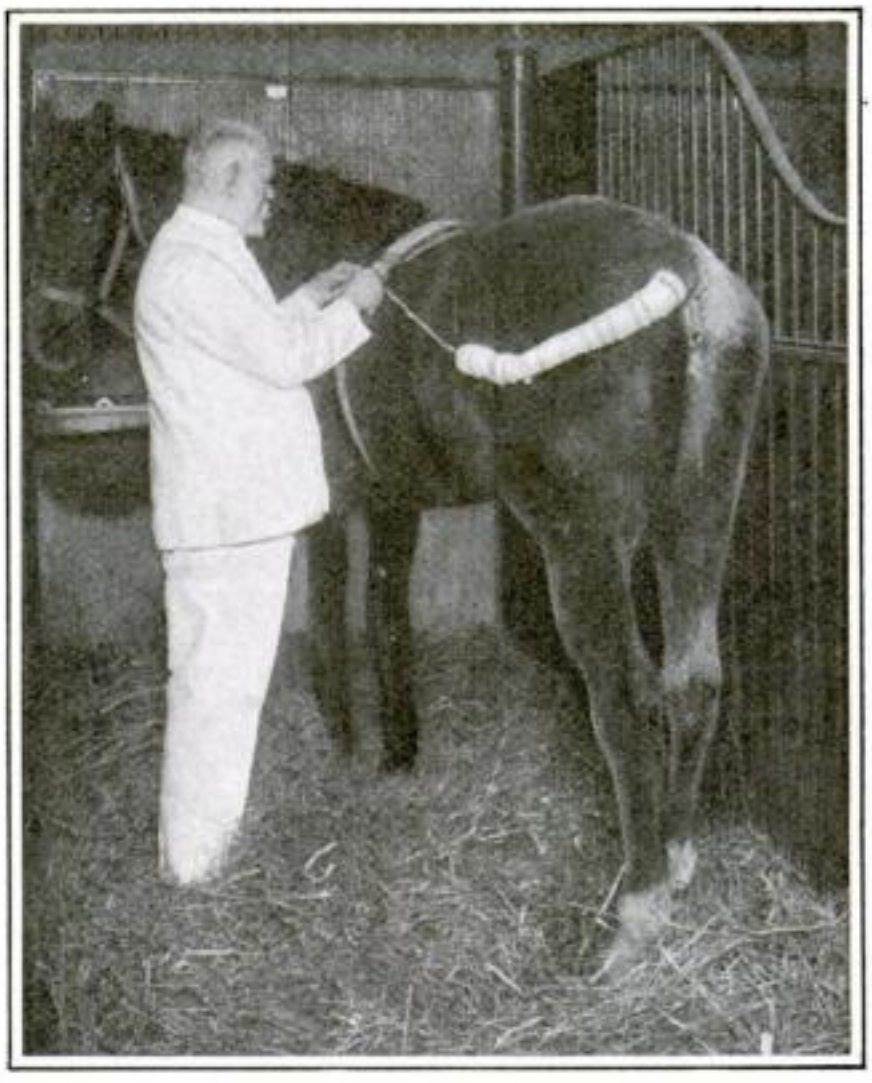
patients have recovered sufficiently to take exercise they are allowed the privilege of a specially designed roof-garden, but only for the number of hours prescribed by the doctor.

Because of their size and weight, the handling of wounded or sick horses has always presented a difficult problem. That problem has been most admirably solved in the hospital of the American Society. As soon as a horse has met with an accident in the street a policeman or the driver immediately sends for one of the A. S. P. C. A. ambulances. A big automobile ambulance responds, and the ambulance surgeon gives what aid he can. The running-board of the ambulance is drawn out. It is but the work of a minute to rope the horse's feet. At a given signal the ambulance attendants pull the ropes, thereby turning the horse over, so that he lands on the running-board. He is then firmly strapped to the board, and an electric motor inside the ambulance hauls the running-board back into place. While on his way to the hospital the horse is as comfortable as possible. When the ambulance reaches the hospital it is driven on a large elevator which takes it up to the top floor, where the operating room is situated. If the horse is unable to walk, a sling is passed around him while he is still attached to the running-board. The sling is then fastened to a trolley which leads into the operating room. He is laid upon the table without once having had to make the effort to stand.

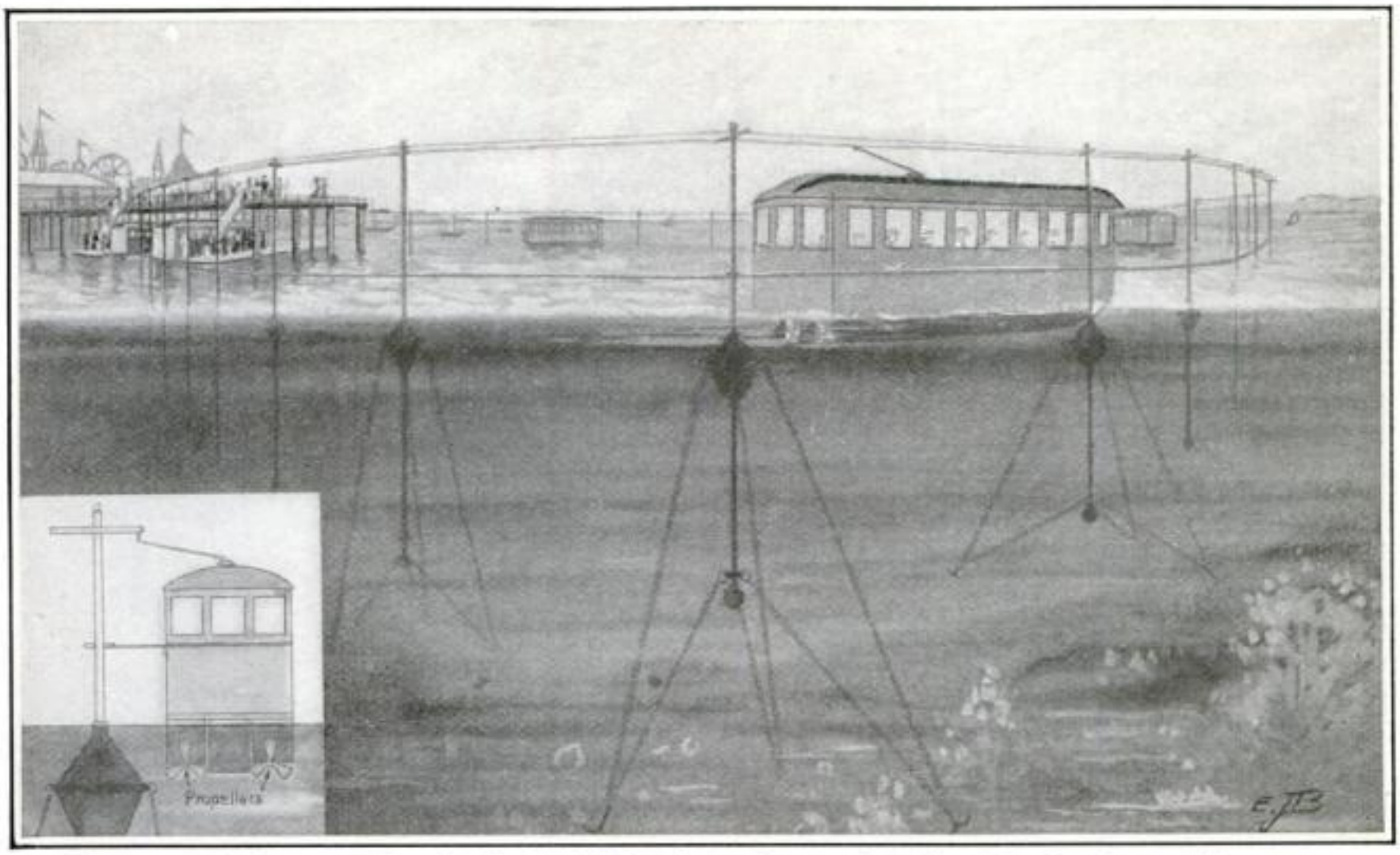
When the animal's wounds have been dressed, he is trolleyed out of the operating room and into the ward and placed in one of the stalls. A horse which cannot stand is slung up and kept in the sling until he regains the use of his feet.

The operating table is fascinatingly ingenious. The horse is made to recline on a cushioned frame. Although perfectly comfortable he is so firmly strapped in the frame that he cannot hurt himself by kicking or struggling. The table can be raised or lowered by a lever, so that the surgeon may perform his work as easily and as expeditiously as possible.

Dr. T. S. Childs, the surgeon at the head of the hospital, has performed some remarkable operations on horses. One of his charges was a famous racer which had fractured the bone above the hoof. When the horse was placed on the operating table Dr. Childs found that the bone was so badly fractured that it had penetrated the skin; aside from being broken the animal's leg was badly lacerated by the bone. Part of the bone had to be removed, after which the leg was set. The leg was then placed in a plaster cast in which a small hole was left for draining the wound. The patient was supported in a sling but he appeared so unhappy that the doctor allowed him the liberty of a large box stall, one of the hospital's "private rooms." There he finally recovered. This horse was very intelligent and seemed to realize that everything was being done for his comfort. He took the best of care of



A view in one of the wards. The horse which the surgeon is dressing was seriously wounded by backing into a large steel hook which tore through the flesh of his tail and came out over his hip. He is a valuable cavalry horse and is the favorite mount of one of our colonels. Although his injuries were such that he had to submit to an operation, he will soon be back doing what he can for preparedness



The seventh heaven of a bather's delight is to be attained in this floating trolley-car—according to its inventor. The favorite recreation of letter-carriers is said to be walking. On the same principle city-dwellers presumably must bathe in trolley cars

his hoof, learned to hobble around on three legs and even acquired the trick of lying down and getting up without placing any weight on that leg. Four months in the hospital would be an expensive period for an ordinary horse. But this one was valued at $50,000.

Another remarkable case which Dr. Childs handled successfully was that of a horse which had broken three ribs. To-day that horse is back on the street.

These cases are mentioned only to give an idea of the work which is done in the field of veterinary science. Cats and dogs are brought to the hospital with rubber bands wantonly placed around their tails, legs or necks. The bands cut into the flesh and cause the animals to lose their tails and often their legs.

Cats seem to have a habit of swallowing needles. When a cat is brought to the hospital suffering with a cough Dr. Childs looks for a needle. In one instance he operated on a cat to remove what he thought was an ordinary needle. He found a hat-pin nine inches long. But the cat's life was saved. Dr. Childs has distinguished himself as much by his work among small animals, such as cats and dogs, as he has among horses.

The Trolley-Car Boat for Bathers

A FLOATING, electric passenger car service combining the pleasures of boating with the conveniences of trolleying is the daring proposal made in a recent patent. The trolley-boat is intended to enliven seashore bathing-resorts, as if they were not lively enough now. The cars used are similar to ordinary trolley cars, but, instead of being mounted on wheels, they have two oblong floats, pointed at their front ends for cutting through the water. At their rear ends are propellers.

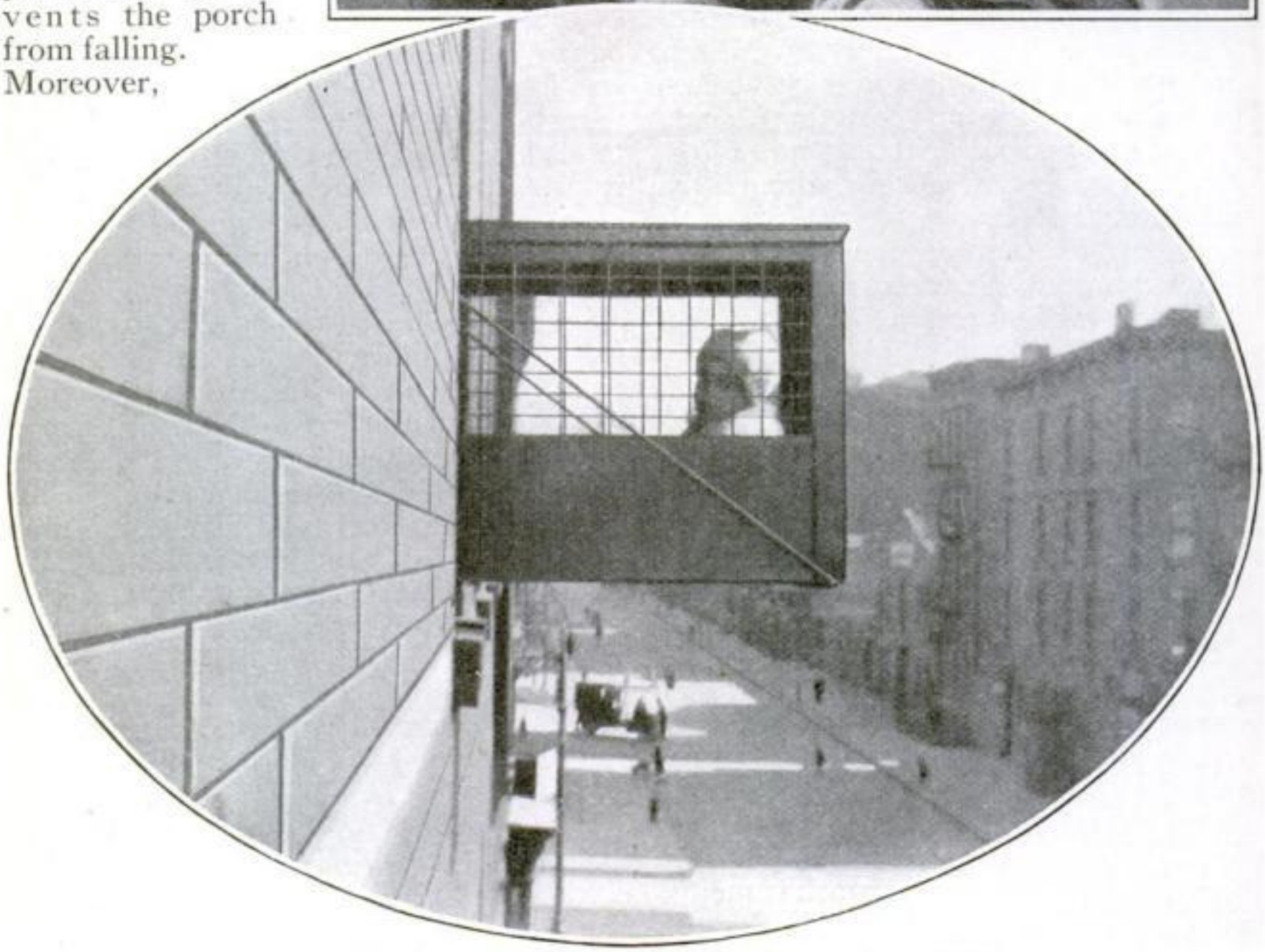
The current is supplied by conductors, supported by cross-beams attached to steel poles. Each pole has a weight at the bottom and a buoy in the middle, just submerged in the water. The whole structure is anchored to the sea bottom with chains. The weight maintains the vertical position of the pole; and the buoy, remaining at the same distance below the surface, makes it possible to run the cars at high or low tide.

The car is supplied with a regular trolley-pole, provided with three contact wheels, one pressing against the under surface, and one on either side of the conductor. On the tops of the poles are electric lamps for illumination at night.

Outdoors Yet Indoors

IN an effort to solve the fresh-air problem for city babies several enterprising inventors have devised arrangements whereby youthful Americans can be given all the fresh air they need and given it in perfect safety, at the same time allowing their busy young mothers plenty of time to do housework. As a result, manufacturers have already produced for the market tiny sleeping-porches which can be placed outside any window.

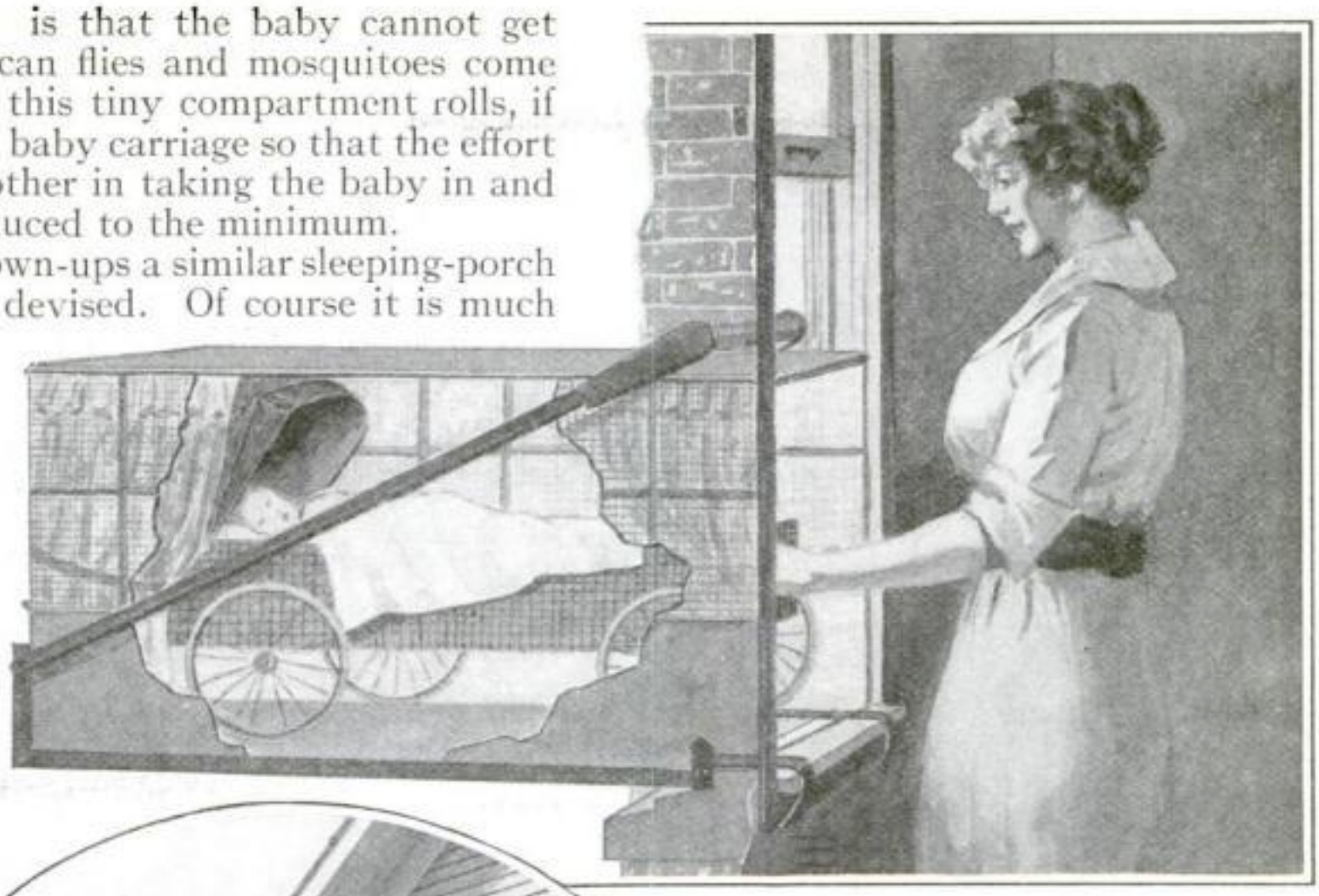
An iron brace capable of sustaining a weight of five hundred pounds prevents the porch from falling. Moreover, stout braces anchor the cage to the side walls in such a way that the strongest of winds are robbed of all danger. Another feature of the miniature sleep-



One hundred feet in the air—a sleeping-porch for babies

ing-porch is that the baby cannot get out, nor can flies and mosquitoes come in. Into this tiny compartment rolls, if desired, a baby carriage so that the effort of the mother in taking the baby in and out is reduced to the minimum.

For grown-ups a similar sleeping-porch has been devised. Of course it is much larger, much more elaborate and more expensive. In order to diminish the high cost that the installing of a sleeping-porch usually entails, a western manufacturer has put on the market a hanging sleeping-porch to be suspended from stout iron straps lugged to the side of the building. The porch fits over the window of the bedroom and is provided with curtains which can be raised by cords from the bed. The porch has been so carefully designed that, when properly installed, one of them will sustain a weight of about a thousand pounds. This contrivance will not disfigure the appearance of any dwelling and is not expensive.



Above, the way the baby sleeping-porch is applied and used in a city flat. Below, another view of a similar device. At the left is a sleeping-porch, easily applied, in which a grown person can sleep in safety and unmolested comfort

Soldering-Iron Has New Principle

AN electric soldering-iron which heats the object to be soldered only at the actual point of contact, thereby doing away with much of the loss of heat

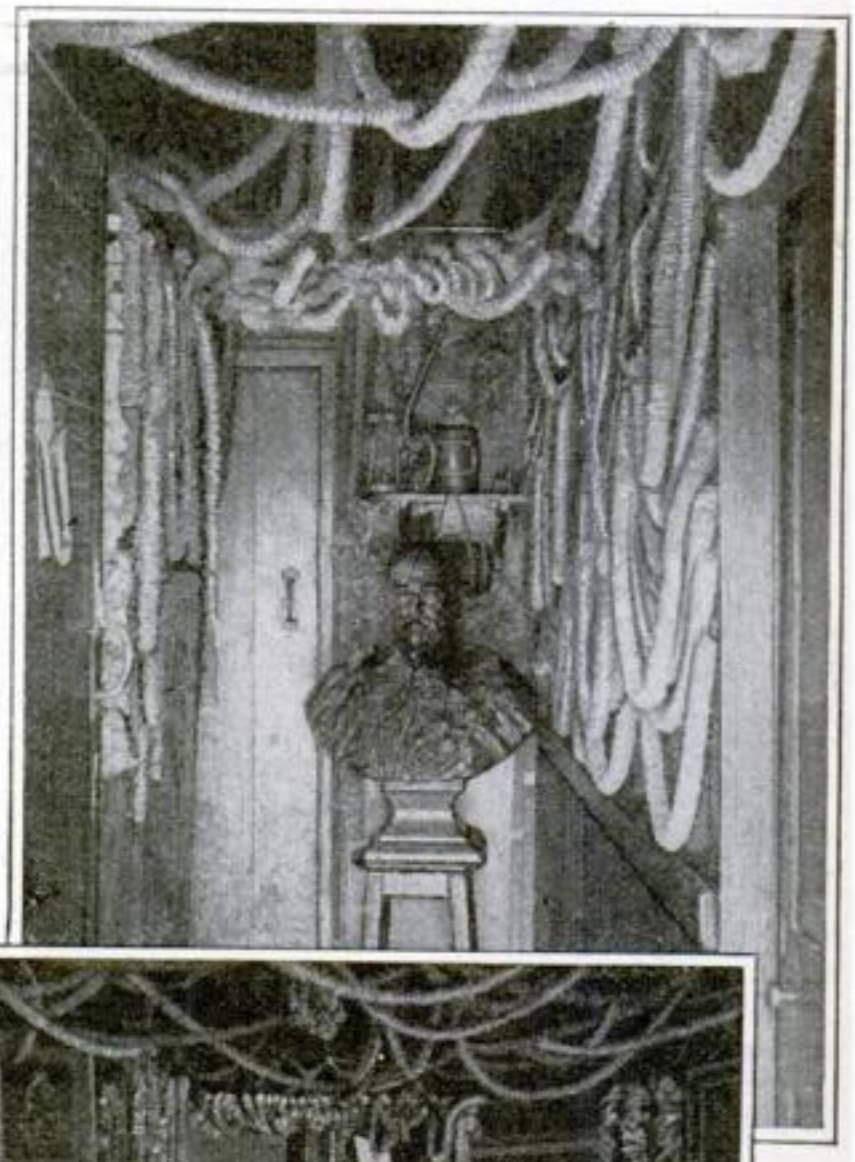
To obviate loss of heat by radiation, this soldering-iron has been invented. It heats the object to be soldered only at the point of direct contact

by radiation in the old-fashioned iron, has been put on the market for work of all kinds. The iron, which is made in various sizes, is connected with a step-down transformer.

Heat for soldering is generated by the resistance of carbon or carborundum contacts against which the object to be soldered is placed. The other contact, through which the current flows, is metal and will heat but slightly. No current is used until the object to be soldered is placed between the brass and the carbon contacts. It is said that with this new form of electric iron, soldering can be done in about half the usual time.

A Room Papered with Postage Stamps

WITHIN easy walking distance of the old cathedral town of Chichester, England, is the "Rising Sun," in North Bersted, a house of interest to all who collect stamps. This small inn contains a room every inch of which is covered with postage stamps. Ceiling, walls, doors, chairs, tables, picture frames, every part of the room, except the floor, is thickly covered, while from the ceiling hang long festoons and ropes, made of bundles of stamps for which there is no other place. Fully two million stamps are pasted up, and a million more hang in the festoons. Great bundles, one of which contains sixty thousand stamps, hang among the heavy loops.



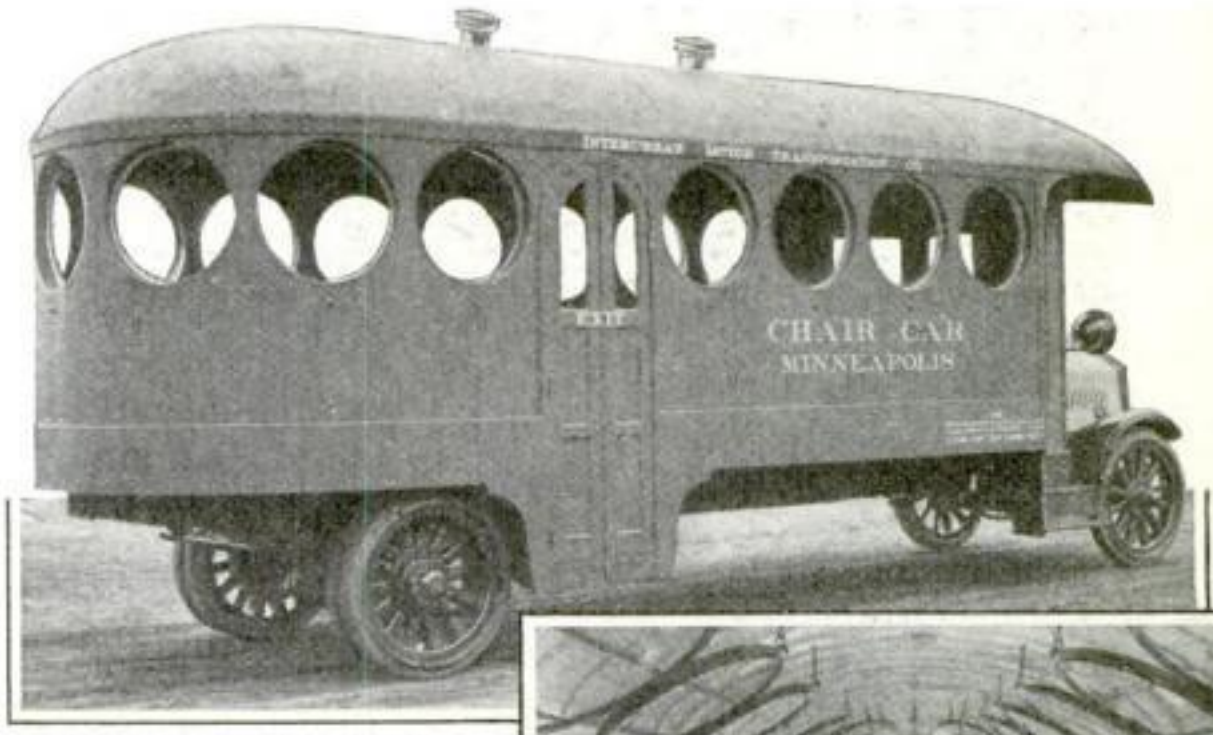
Of all English inns the "Rising Sun" is the most curious. It has a room, every inch of which is covered with postage stamps—ceilings, doors, picture frames and tables. There are so many stamps that some have to be disposed of in long festoons and ropes, which hang from the ceiling

The Chair-Car—the Latest Development in Stagecoaches

MINNESOTA has returned to the good old days of the stagecoach, although those of the natives who can recall the romantic journeyings of the clattering vehicle would have some difficulty in recognizing the coach in its revised, 1916 edition. The cracking blacksnake whip, the plunging horses and the picturesquely cursing driver give way to the almost silent whirring of a gasoline motor. In place of the hard and crowded seats, there are soft leather chairs, with comfortable, springy backs and an arrangement of springs in their bases which absorbs all the shocks that the shock-absorbers of the vehicle itself overlook.

Gone also is the close confinement of the stuffy old coach, with its romance-nourishing darkness, where the young adventurer could hold hands in perfect safety with some fair passenger. For the new highway coach is brilliantly lighted by great round windows, not unlike the portholes of steamers. At night, incandescent bulbs shine in the ceiling.

This modernized stagecoach clips off the distance between Minneapolis and St. Paul over fine macadam roads. The fare is twenty cents, which lifts this particular highway coach from the despised jitney class.



The modern stagecoach looks like a ship

Inside, the seats are comfortable and there is plenty of light

A soda-fountain table that is convenient and sanitary and handsome as well

A Sanitary Refreshment Table

An attractive and extremely durable restaurant table is made with heavy metal legs and four swinging stool seats of mahogany or oak finish. When unoccupied these stools are out of the way under the table.

The tops are noteworthy. They are pure white, of a solid material, made by melting crushed onyx at a temperature of two thousand six hundred degrees Fahrenheit. This material does not absorb or craze, is as easily washed as glass, is unaffected by acids, and strong enough to endure hard usage.

In addition to being a very compact and handy arrangement for ice cream parlors, especially in small stores, these tables can also be used outdoors, obviating the trouble of carrying chairs as well as tables.

A machine which cleans out knot-holes and then plugs them with a solid piece of wood

A Machine Which Plugs Knot-Holes

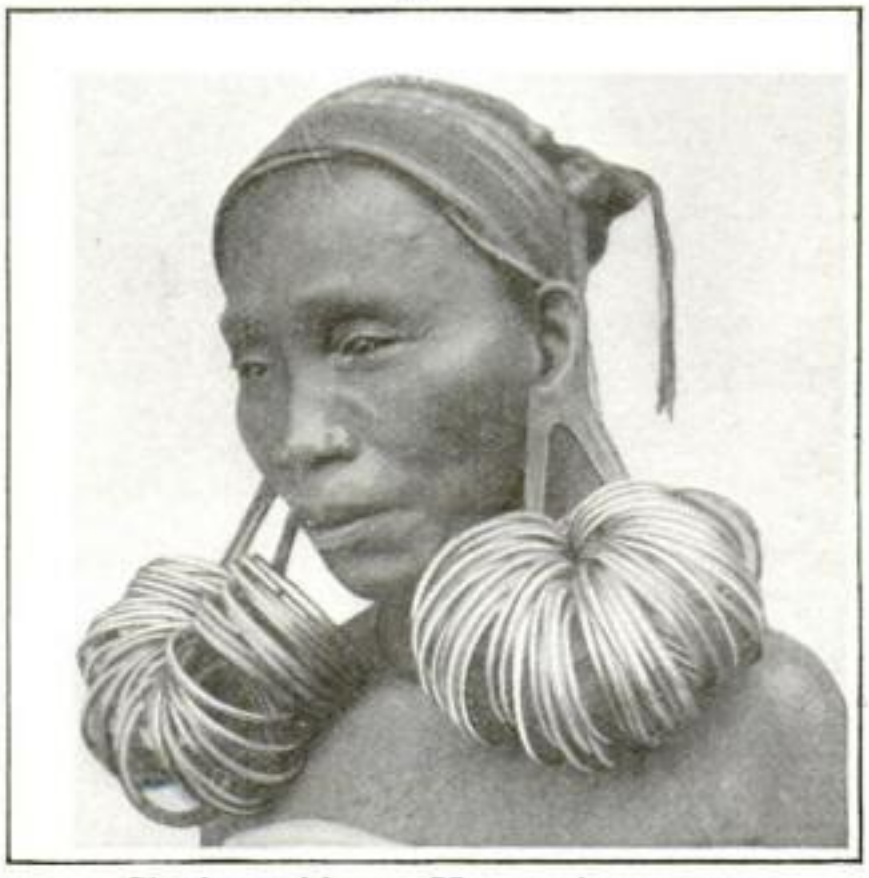
THE machine shown in the accompanying illustration is the invention of Merton J. Miller, a wooden-box manufacturer, of Los Angeles, California. Designed for the purpose of assisting in the plugging of knot-holes in box shook, it may be equipped successively with two different sizes of circular bit-like saws—one of which is used to eliminate the knot or reduce the knot-hole to a perfectly round hole, and the other of which, slightly larger, cuts the plugs used to close the holes.

The plugs are inserted in the shook by hand and fastened in place with crimper nails. Plugs are usually kept in stock, of various thicknesses, and as the lumber is cut up into shook the pieces containing loose knots or knot-holes are laid aside and later transferred to the boring machine. Box lumber is generally of rather inferior quality, and hence full of knots; and by the use of this machine a very great saving in lumber footage is made possible. The plugging of knot-holes in this way in a box factory that turns out ten thousand feet of box-lumber in a day can be done by one man working only three or four hours per day.

Earrings that Denote Widowhood

THAT India is a land of curious customs is confirmed by examining the accompanying illustration. This woman is a native of Garo, a province of Eastern Bengal. She is a widow; but instead of wearing black crêpe, she dons these ponderous earrings made of solid brass. Since her widowhood is perpetual, she is obliged to wear them the rest of her life. Each year another ring is added. The large number of rings would seem to indicate great age; but in India girls are married when only five or six years of age, and frequently are widowed at eight or ten.

The constantly increasing weight of metal stretches the lobe of the ear, to which they are attached, in the extraordinary manner depicted. It is safe to say that no widow ever forgets the fact of her widowhood when wearing such a clumsy weight.



She is a widow. Her earrings are a badge of mourning

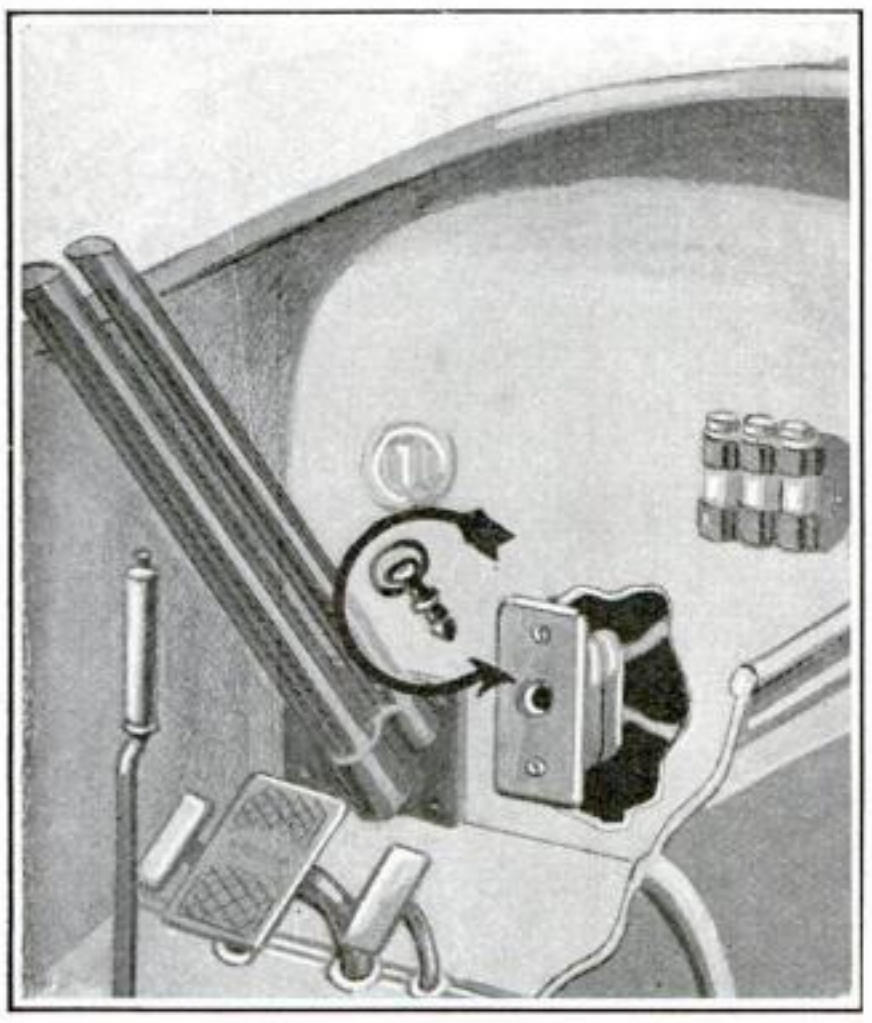
A Tomahawk Grease-Gun

COMBINING the advantages of a grease-gun with that of a spring-separating device, the tomahawk spring lubricator is a most interesting new tool. As the illustration shows, it is a small steel tomahawk, the hollow handle of which is filled with soft graphite lubricant. By a turn of the wrist, this lubricant is forced through a canal into the "edge" of the tomahawk, and thence between the leaves of the creaking spring.

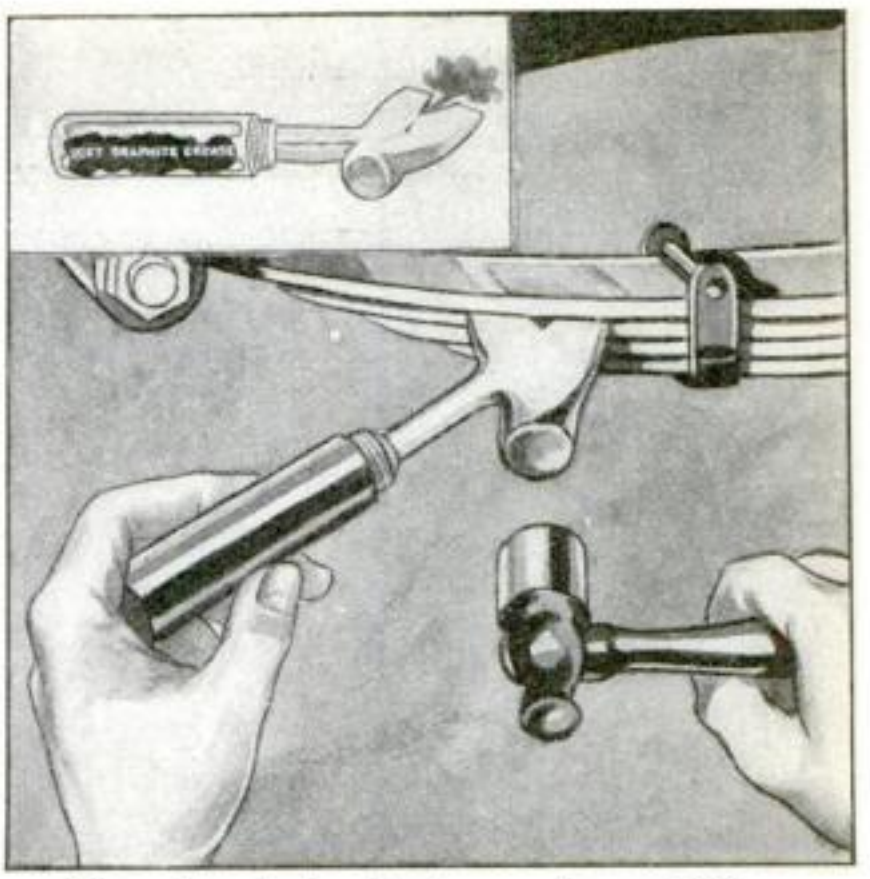
The directions for this tool are the simplest: Hold the edge of the hatchet against the spring to be lubricated, strike a blow with a hammer on the striking butt and turn the handle with the left hand. A goodly quantity of lubricant is promptly forced between the spring leaves. Although the tool is particularly intended for small cars, it can be used on any sized spring on automobiles or trucks. All that is necessary is a heavier hammer and a stronger blow.

A Socket-Protecting Knot

AMONG the essentials required in the electrical element of factory operation is the convenience of the adaptable extension lamp. Considerable trouble is experienced in making plugs and sockets last more than a few weeks.



This switch grounds the magneto and makes automobile thievery impossible



Here is a device that saves hours of time in greasing the leaves of automobile springs

Hence the scheme of putting a knot in their terminal wires, near the socket, before attaching to the cord. This serves for relieving strains and excessive bending of the wires, which in a short time break off, if left straight. Thus the life of the plug or socket is lengthened tenfold. This is a simple expedient, but it works.

Device Prevents Automobiles From Being Stolen

A NEW device intended for the safety of people who leave their automobiles standing on the street or in a public parking space for long periods, has been invented. This is merely a switch which, when the plug is removed, grounds the magneto and prevents the engine from being started. When the plug is pushed in as far as it will go, the switch does not make contact; consequently the magneto is free from grounds. When the plug is pulled even part way out, the switch makes contact and the magneto is grounded, thus stopping the engine. This condition, of course, continues when the button is entirely removed.

No other type of plug could possibly be used to start the car. A ring on the plug can be attached to one's key-ring so that it will not be lost or misplaced.

How a Second-Hand Automobile Made a Railroad Pay

THE Kansas, Southern and Gulf Railroad, a dream of the early 80's, was projected to traverse the wheat belt, connecting the Dakotas with the Gulf Coast. Work started at Blaine, Kans., and after twelve miles had been completed to Westmoreland, the county seat, the promoters could find no further sale for their bonds and had to abandon construction. For equipment they had two engines and two cars.

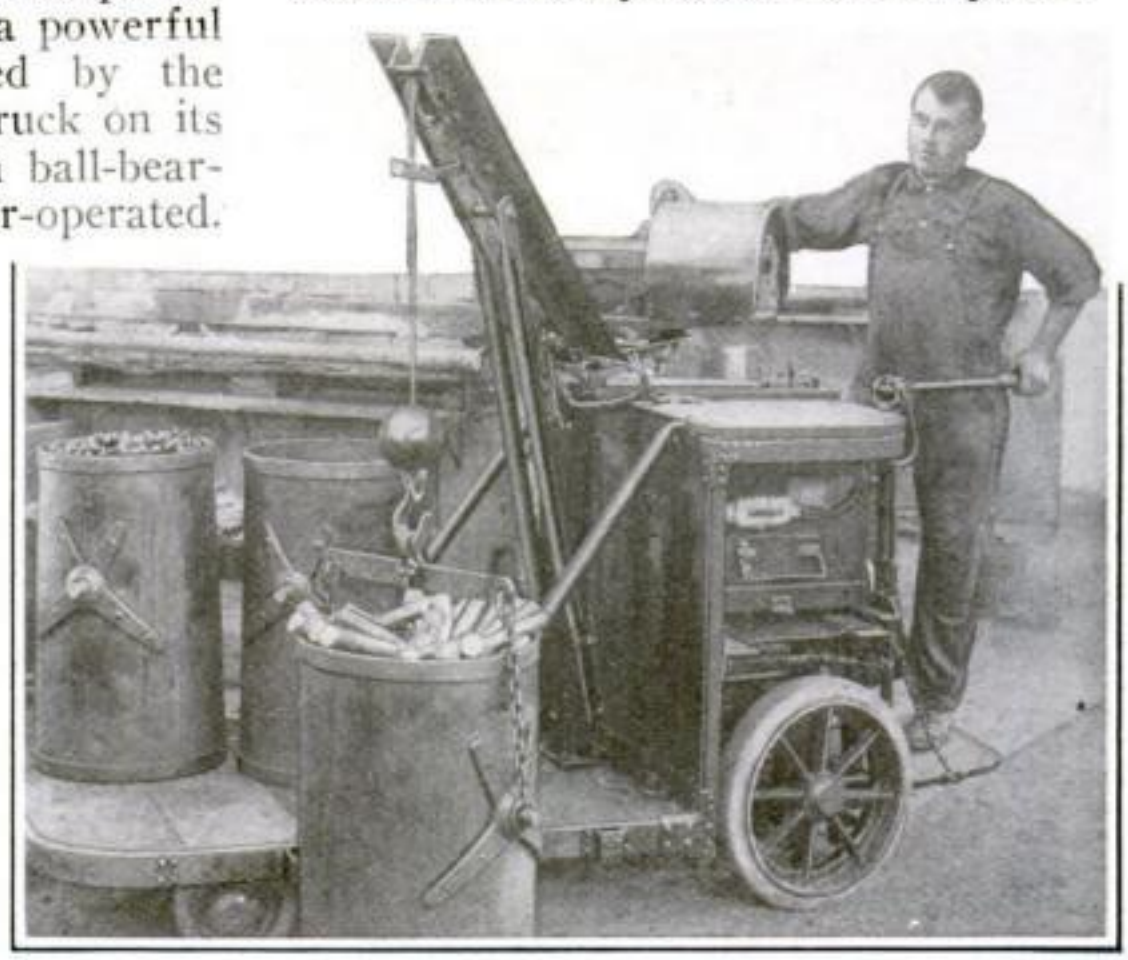
A second-hand automobile which made it possible to operate a bankrupt railroad profitably

The road never paid dividends, and even had to borrow money to pay interest on its bonds. About five years ago the engines wore out, and there was no money for repairs. The State took charge and appointed C. E. Morris as receiver. Morris traded the two locomotives for a reasonably good one and kept the trains going with some regularity. He also got a court order that let him raise the freight rates, and charge five cents a mile for passenger fares. But even this would not make the road pay expenses. About two years ago Morris disposed of the old engines and purchased a second-hand automobile. For the front wheels he substituted the trucks of a hand-car, and for the rear wheels two locomotive front wheels. The body had room for six passengers, besides the driver, and Morris built some miniature freight cars, by putting bodies on hand-cars. The road now has three freight cars, each with a capacity of two tons, and is not only giving satisfactory service, but is making money.

Lifting Made Easy

AN electric trailer-truck employed for shop and factory transportation has been equipped with a powerful and compact crane operated by the same energy that sends the truck on its way. The crane revolves on ball-bearings, and the hoist is motor-operated. The steel barrels loaded, have a weight of seven hundred pounds and the electric lifting arm will pick them up easily and lift them over the side of the truck. The platform of the truck itself accommodates three barrels. It is very hard to attempt to hand-truck barrels of such weight over perfectly smooth floors and over floors of uneven surface it is almost impossible.

The truck itself is also used for drawing trailers from one location in the factory to another, and with the addition of the new crane and lifting arm the trailers are easily loaded and emptied.



This truck runs around the shop and picks up and transports barrels and castings

The Screen Player's Make-Up

What the Camera Does to Your Face

By Horace A. Fuld

ANY textbook on light will tell you that white light is a composition of rays forming what is known as the spectrum, and ranging from violet and blue through green, yellow and orange to red. There are also rays and colors on each end of the spectrum, for instance, ultra-violet on the violet end, not visible to the human eye. The rainbow is a common example of the spectrum. When light strikes an object certain of these rays are absorbed. The unabsorbed are reflected, and the proportion of the reflected rays gives the object its color. Therefore light is a question of absorption and reflection.

The film is almost as sensitive to violet rays as it is to white light itself. Blue diminishes the sensitiveness but little. With the greens and the yellows we begin to notice a decided diminution. In other words the film is most sensitive to the violet end of the spectrum and least so to the reddish colors. This explains at once why red hair photographs black, for the film is almost entirely unaffected by these reddish rays.

Two more factors influence the use of

At left, J. Frank Glendon without make-up. Note the natural darkness of the skin. In middle, the same actor properly made up. Flesh tint lightens the tone of his face to the proper shade for motion-picture work. At right, the same make-up overdone, showing too much red on the face, eyes too heavily lined, eyebrows too black and too much red on the lips

When light comes in contact with a brick all the red rays are reflected, which gives the eye the impression we call red. The corn flower, on the other hand, is blue because virtually all rays except blue and yellow are entirely absorbed. This, in brief, is the theory of color.

The ingredient common to every form of photographic film is a silver salt, in emulsion form, spread on a celluloid base. When white light is admitted through the shutter of the camera it strikes the iodide or bromide of silver and reduces it to a metallic state. Thus, in photographing a scene, light objects will be responsible for a chemical change in the salt, the extent of the change depending upon the brilliancy of the object.

colors in camera work. These are reflected light and intensity. When light strikes an object, so that some of it is absorbed while a portion is reflected to produce color, still another portion is reflected, without any change, as white light. This is known as reflected light. Illuminating the object enables us to photograph, as well as see it.

All these facts must be borne in mind by motion-picture actors. The colors that actors use in their make-ups differ. At one studio, for instance, red in varying shades is the favorite, with no special reason apparently; at another, blues are

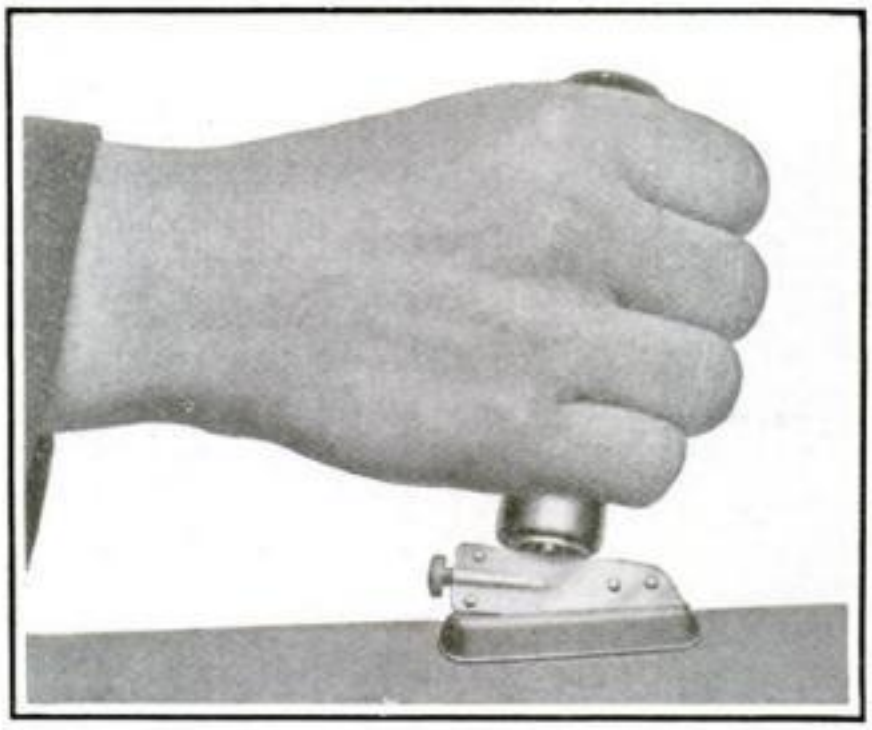
the subject of constant experiment. Theoretically the blues are the most sensitive, yet some companies insist that other colors be used. The net result of color on the film is gray, and provided the right tint is obtained, the color preference of the individual make-up specialists does not matter at all.

Browns are depended upon to make up Indians, Malays and other characters of dark skins; but a very little brown goes a long way, for brown is a combination of red, black and grey, evidently a dangerous and dark-colored combination.

For mulattos or negroes a darker shade of the same pigment is all that is required, although there are special preparations for the negro make-up. Of course, our knowledge of film color-value teaches us that other dark tints might be used instead of brown or black, but the use of the correct color has another advantage. It tells the usually ignorant "super" or "extra" what he is for the moment. There is a good deal in feeling the part, most actors tell us.

Occasionally an actor will be found with a peculiar skin, one that contains unusual pigments, and it invariably photographs very dark. The cure, in case of extreme darkness, may occasionally be accomplished in the developing room. Ghastly faces to accompany death scenes are obtained by a liberal application of white make-up.

Both facial make-ups and costumes are influenced by the color of the background. An experienced actor, called in to take part in a certain picture, will, before making up, carefully examine the color of the set in front of which he is to act. He does not want to make up, especially in the matter of clothing, too nearly the color of the set, for in that case he would not stand out from the background. Yet he has a still greater fear of dressing so as to create too sharp a contrast, for too great contrast is the despair of the man in the darkness who develops the film. If an actress wears a white shirt-waist against a black background, one of two things happens, either the film is over-exposed, or it is under-exposed. It takes much less time to develop the white than it does the black, and if both are shown in contrast in the same scene, one or the other will suffer. This theory of contrasts also holds for the colors. Reds and blues make a poor combination, either in the setting or in the actor's or actress's clothes, or in the facial make-up, for the blues develop faster than the reds. In fact, it is always better to use in one scene adjacent colors of the spectrum.



Any sort of cardboard box can be opened without breaking the contents if this handy knife is used

Occasionally you will notice an actor or actress with lips and cheeks to which the color has been too liberally applied. This is over-zealousness in an attempt to counteract the blue rays from the overhead lamps by means of which the studio scenes are lighted. As all lamps in common use give off a large percentage of blue rays, reds and yellows suffer in proportion, so that it becomes necessary to apply a color that will compensate this elimination.

Novel Box-Opening Knife

A NOVEL knife for opening pasteboard boxes of groceries and in fact any sealed cartons without danger of cutting one's fingers or projecting the knife into the contents of the box, has been recently invented.

The knife is a short blade projecting centrally from an angular shoe, the sides of which are at right angles to each other, so as to form a channel adapted to run smoothly along the edge of a box while the blade slits its edge.

Poison Gas for American Pests

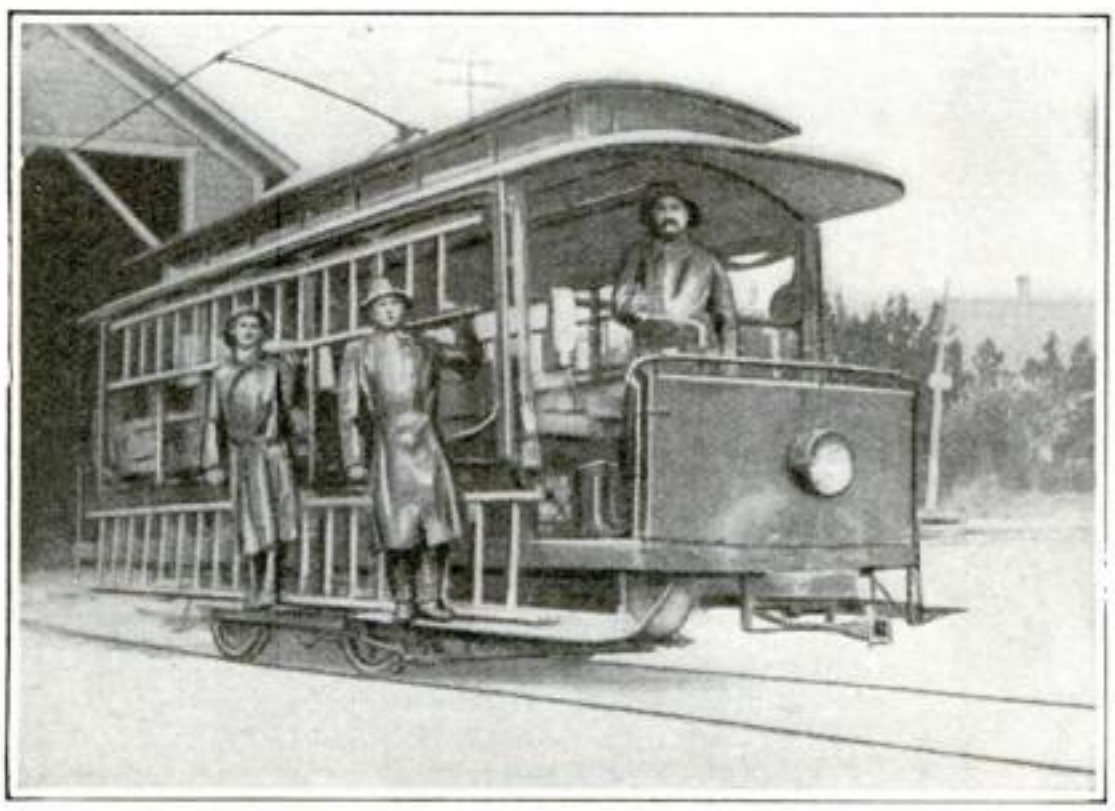
GAS that is far deadlier than the poison gases that are used on the battlefields of Europe is employed daily in America for purposes of stamping out pestilential beetles, moths, and vermin of all kinds. Hydrocyanic acid gas will kill a man if he inhales a single lungful. Yet its deadliness, when controlled by man and directed against his many small destructive enemies, is so desirable that the Department of Agriculture has issued an order requiring citrus crop growers in California to apply it to their plants to combat scale, the mealy bug and similar destroyers.

Preparing to rid a greenhouse of insect pests by means of deadly gas

The gas is produced by dropping tablets or measured amounts of cyanide of sodium into sulphuric acid. The room in which the gas is generated is well sealed. Different plants require different amounts of the gas for thorough fumigation, the dose of sodium cyanide varying from five ten-thousandths to five thousandths of an ounce per cubic foot of air space. The former amount is sufficient to kill ordinary green flies; the latter will deal death to sow bugs.

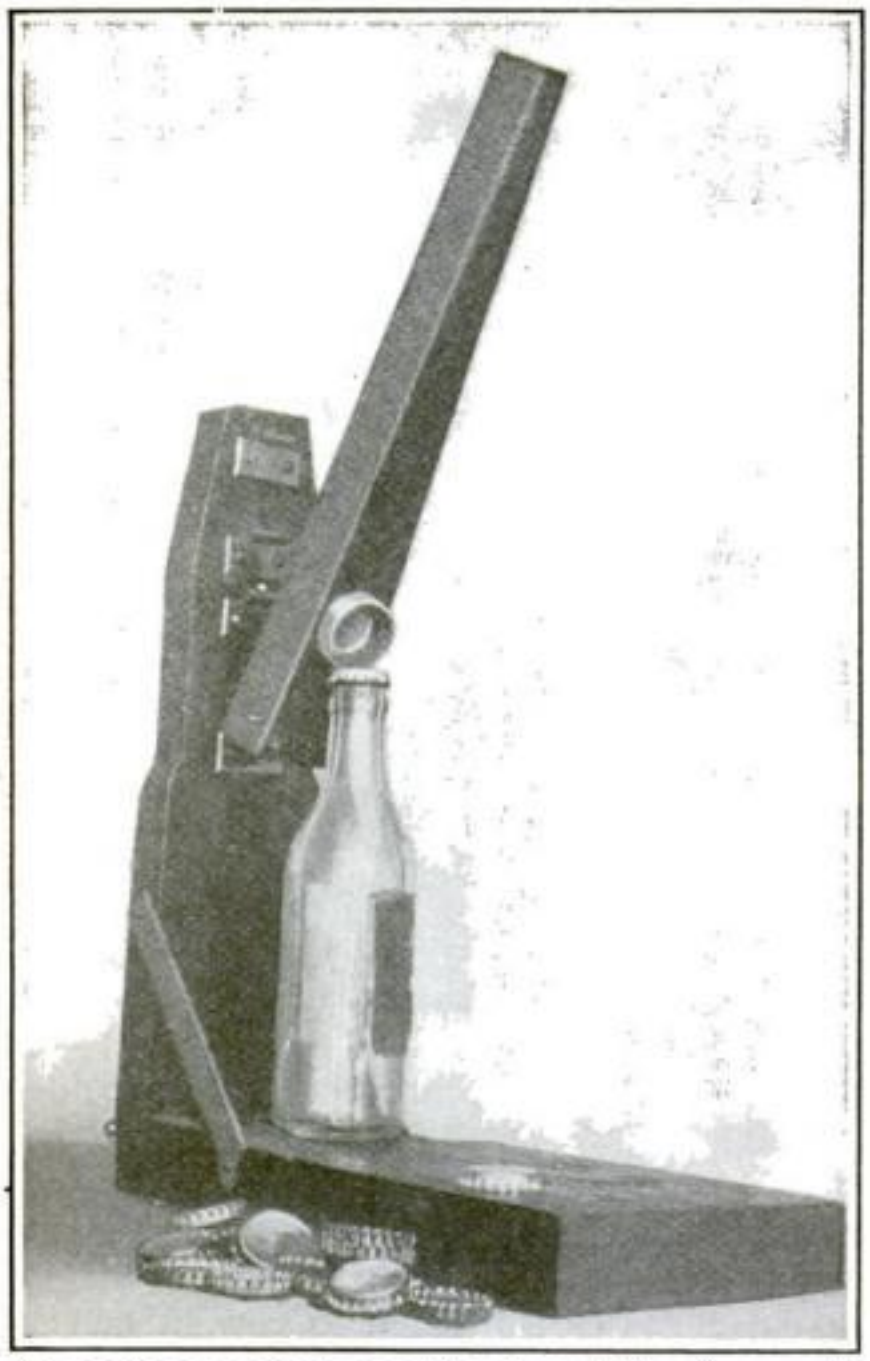
A Fire-Fighting Trolley-Car

DULUTH has a fire-fighting trolley-car which is used for detached suburbs where poor roads or other barriers prevent ready response by motor or horse equipment to alarms of fire. The harbor of Duluth is formed by a narrow strip of land extending across the western end of Lake Superior. This strip of land, four hundred to six hundred feet in width, extends for a distance of seven miles from the Minnesota to the Wisconsin shore. About three miles of it, extending from the Duluth shore, is built up with summer houses and permanent residences of expensive construction. This suburb, Park Point, is so narrow that only one street is laid out, and on this street the track is laid.



A suburban fire department which finds an old streetcar an efficient motor fire-engine

The city purchased a streetcar which had outlived its usefulness, but which was still in fairly good condition. After the seats were removed a hose-box was installed the whole length of the car and left open at both ends, so that no matter in which direction the car is going, it can carry the hose line from the hydrant to the place where the fire is located.



An easily operated machine for putting "crowns" on bottles

A Bottle-Sealing Machine for the Home

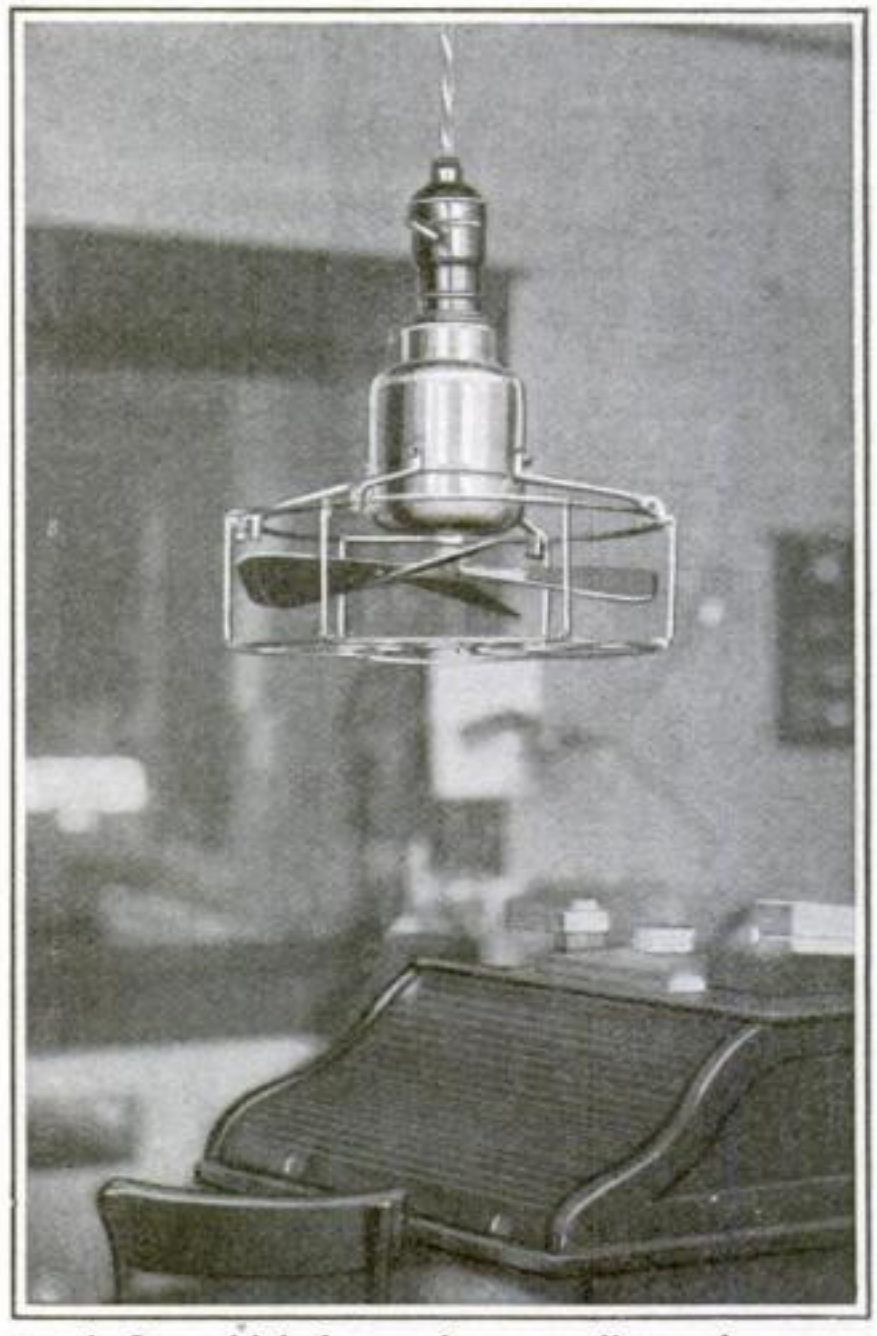
A SEATTLE inventor has patented a light, inexpensive bottling-machine, operated by hand, which may be folded into a compact form. It has a hand-lever with a metal device shaped like an inverted cup mounted near the fulcrum on the under side, so that a pressure of approximately three hundred and fifty pounds is exerted upon the metal caps used to seal the bottles. The lever may be hinged at four different heights to accommodate four different sizes of bottles, so that the bottle-sealer is very convenient for bottling fruit juices, cider or spring waters at home. The metal caps are obtainable at a very low price and are already crimped around the edge, but left flaring to fit over the rim of the neck.

The cup-shaped device on the under side of the lever presses the caps down and squeezes the flaring, crimped sides together, thus sealing the bottle air-tight, since the caps are lined with a cork pad. The machine is constructed of wood and measures about fourteen inches in height and the same in length when set up. It can be packed flat, since the base and upright bar fold together, and the lever is removable.

An Electric Fan Suspended by Its Own Wire

AN ingenious electric fan which may be used in any ordinary electric light socket is shown in the accompanying illustration. As the weight of the fan complete with its socket and guard is but slightly over two pounds, it may be suspended from any light-cord without injuring the connections.

The five-inch fan is operated by a one hundred and ten-volt motor, suitable for either alternating or direct current. The blades run at high speed and throw an air current over a large area. It is said that this tiny fan has met with instant favor, as it saves the space and operating expense of the usual eight and ten-inch fans.

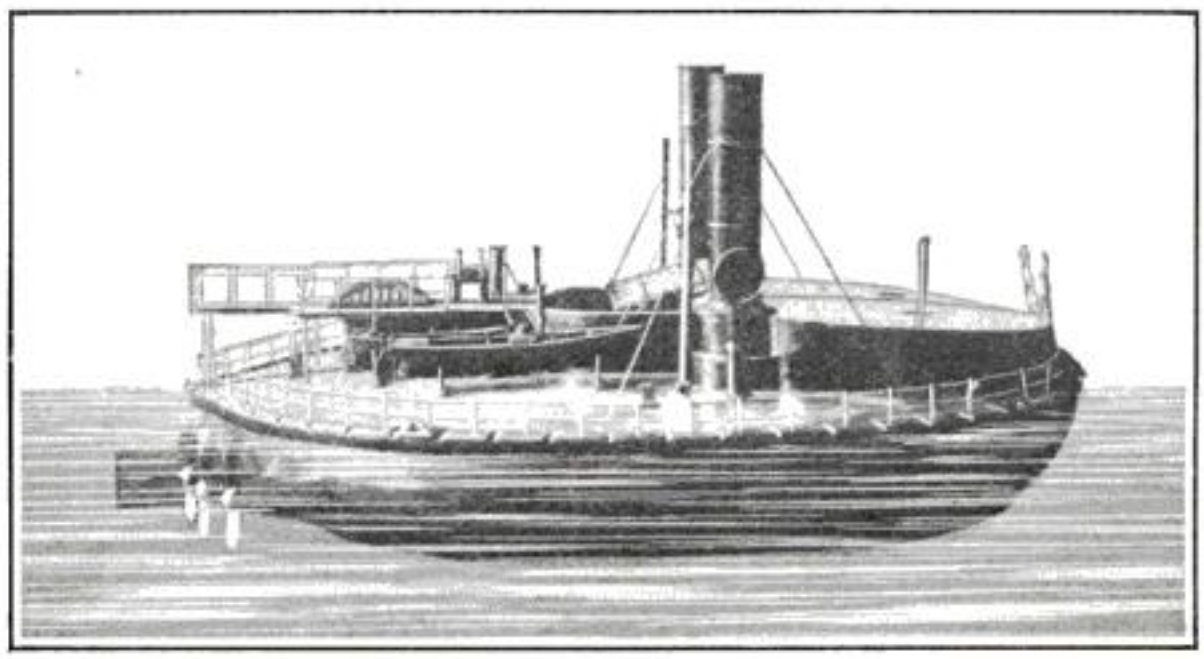


A fan which hangs in an ordinary lamp socket and cools a whole room

Ancient Battleship Ideas Revived

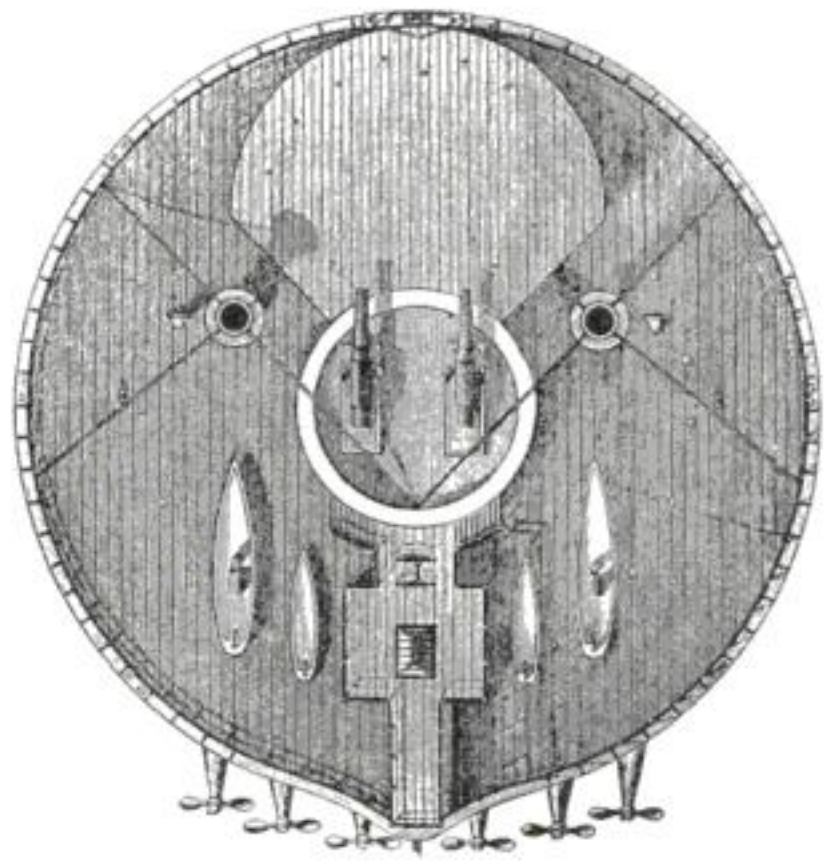
By Percival Hislam

MOST people imagine that the first armored ship was the "iron-cased frigate" *Gloire*, launched for the French navy in 1857; yet the Dutch built an armor-plated vessel nearly three hundred years earlier. That was in 1585, when Antwerp was besieged by the Spaniards. The Dutch took one of their biggest ships, cut her down and erected on the deck a battery with armored and sloping sides, within which they mounted eight of the heaviest guns the factories of the day could produce. The roof of the battery formed an armored breastwork for men armed with cross-bows and shot-guns, and there were gratings in the roof to provide ventilation for the battery below. A redrawn contemporary picture of the *Finis Belli*, as she was called, is reproduced herewith; and notwithstanding the lapse of time, she bears a striking resemblance to the *Merrimac* of the Civil War, which was designed and built on precisely the same principles.



The "Finis Belli," built in 1585, the first armored battleship, and precursor of the "Merrimac" and all armed ships

More than sixty years before the first dreadnought was designed, the famous American engineer Stevens laid down at Brooklyn an "armored battery" which had five gun-positions out of seven on the middle line. In order to save length, the other two guns were placed slightly *en échelon*—a system of mounting found in many British and German dreadnoughts to-day. The Stevens battery would have been able to fire all her guns on either broadside. Unfortunately, she was never completed, and after being on the stocks for over forty years was sold as scrap-iron.



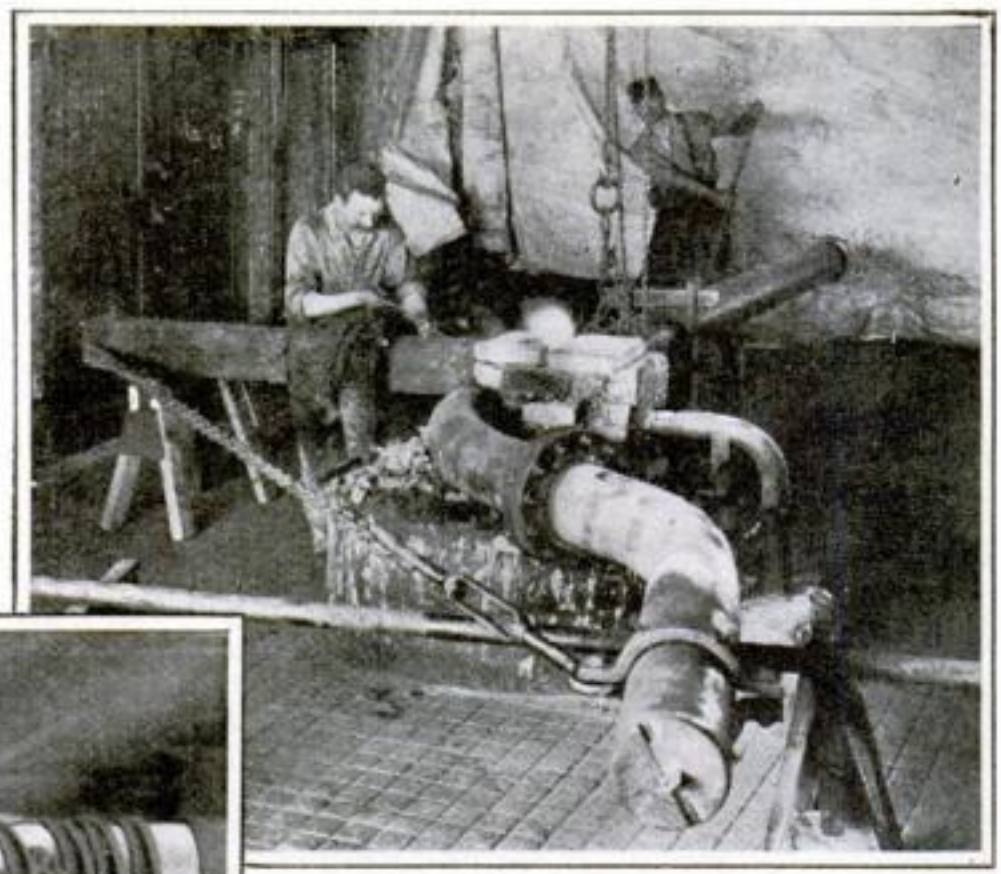
A circular warship of Russian design with six propellers. Two were built, but proved utterly unmanageable at sea

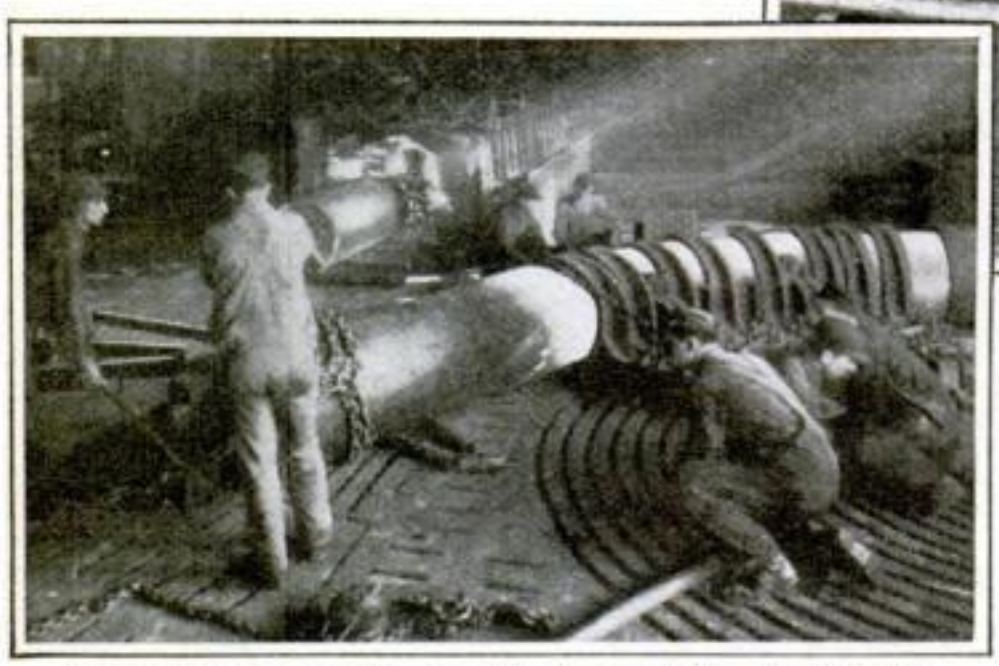
The other illustration depicts a remarkable type of ship built for the Russian Navy in the seventies. They were absolutely circular and fitted with six screws apiece, the armament consisting of two twelve-inch guns in a revolving barbette in the center. Two of these vessels were built, the *Vice-Admiral Popoff* (after the designer) and the *Novgorod*. They proved absolutely unmanageable in anything but a mill-pond, though the idea might have some practical use for coast defense.

Pipe Bending—A Growing Industry

THE growing use of bent pipes in various branches of engineering has called for a systematized method of bending, a process involving mathematical calculations of some difficulty.

Pipe-bends have a variety of applications, among which are the following: to provide flexibility and to compensate for contraction and expansion of steam-lines; to reduce the number of joints, and thereby losses, in pipe-lines; to avoid obstructions such as columns, pipes, etc.; to reduce friction in piping. The commonest use of pipe bends is in the construction of heaters and refrigerating plants. In the accompanying photographs, two large pipes in process of bending are shown. Heavy crane machinery is employed, and great pains are required in applying the heat correctly.





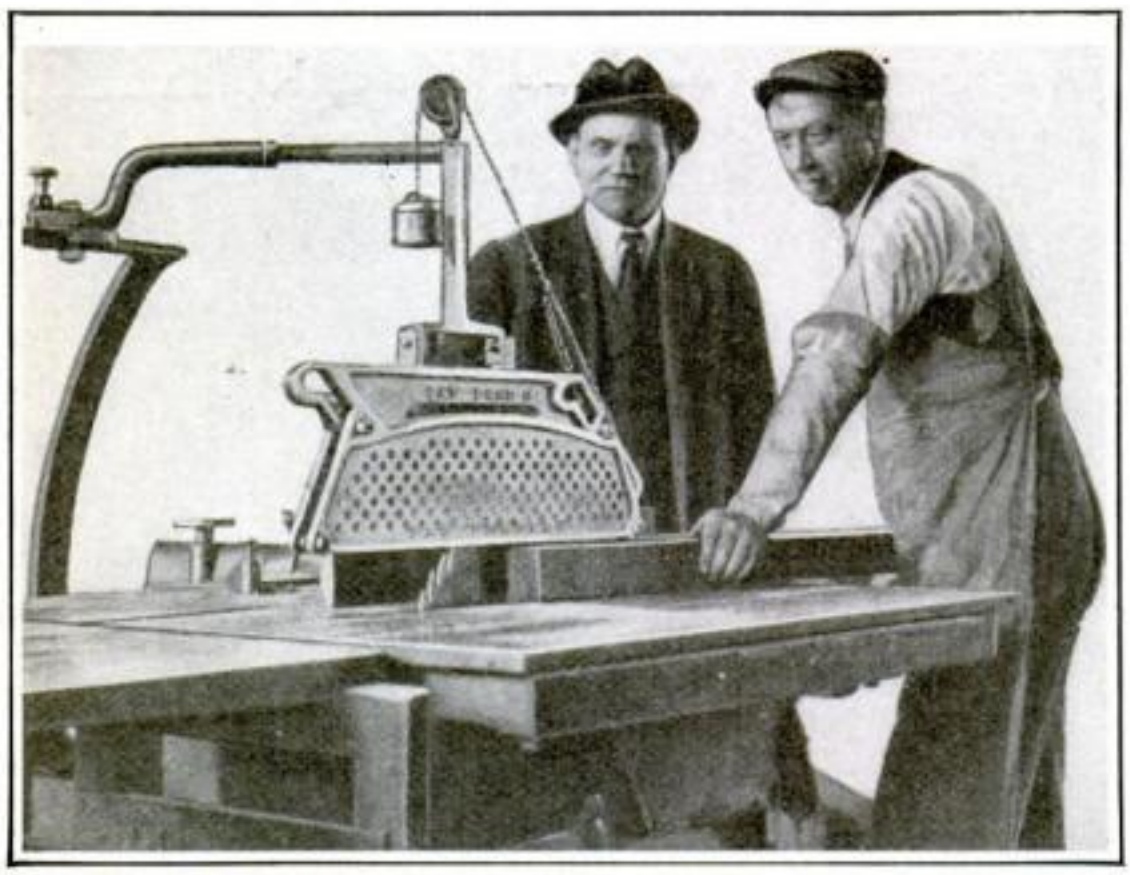
Pipe-bends are necessary to provide flexibility and to compensate for contraction and expansion of steam-lines; to reduce the number of joints, and thereby losses, in pipe-lines; to avoid obstructions such as columns, and to reduce friction in piping

A Saw-Guard Which Has a Clean Record

ALTHOUGH in use in various mills for the past three years, a saw-guard manufactured in Ohio has to its credit a record of no accidents of any kind. The guard is suspended from a bracket over the table and covers the saw completely.

When a board to be sawed is pushed against its lower front end, it automatically rises until the board is under it. When the board has passed through, the guard drops back in place. A small pulley against which the board is pushed, and an arrangement of levers causes the guard to be raised.

The value of this guard as a safety appliance cannot be over-estimated, since saws have always been a source of many accidents.



When a board to be sawed is pushed against its lower front end this guard rises, but when the board passes through, the guard drops

When Should Children Be Held Upside Down?

GREATER love for children hath no man than the one who discovered that the lives of many little children can be saved in certain emergencies, if they are held upside down.

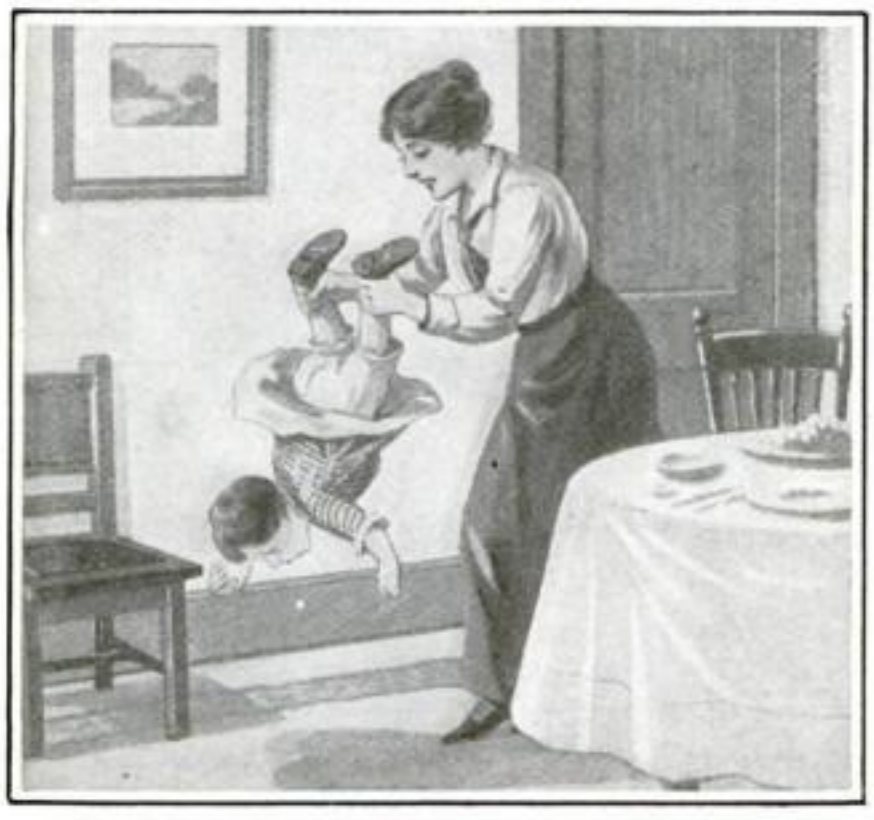
Held upside down, the child's face is safe from the flames

When the clothing of children catches fire if a third of the child's flesh is burned, inclusive of its chest or head, it is very likely to die. Yet if the little one is held upside down immediately after its garments have caught fire, the child's life may be saved.

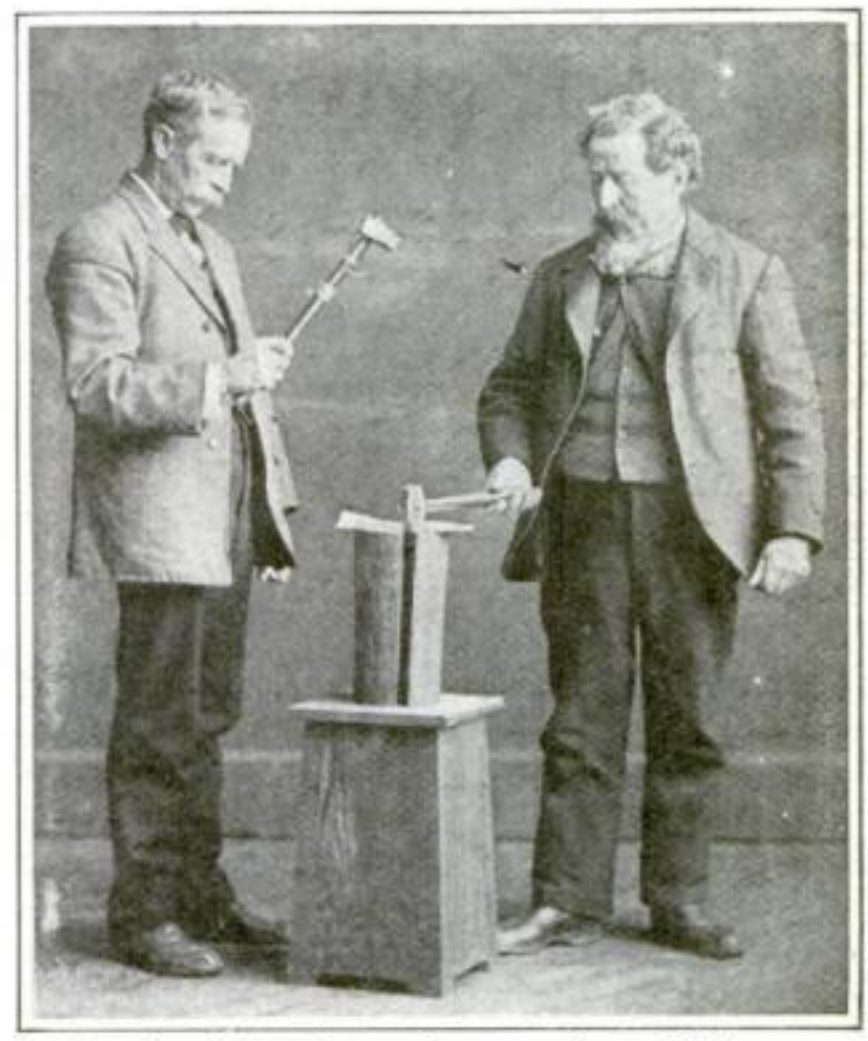
The three-year-old tomboy daughter of a United States Senator was playing a war game with some boys. They were gathered around a camp-fire when the wind carried an ember in her direction and set her clothes on fire. Corporal Hopkins, who had served in an emergency hospital, happened to be at hand.

He seized the little girl by her ankles and held her head down, not an instant too soon. The flames were just about to burn her bosom and curls. Flames have a tendency to rise and a child's face, hair, lungs, heart, and chest are the vital parts first endangered.

Another emergency which demands that the child be held upside down by its legs or feet, is when it swallows a fish-bone, a coin, or a piece of candy.



The coin tumbles out promptly



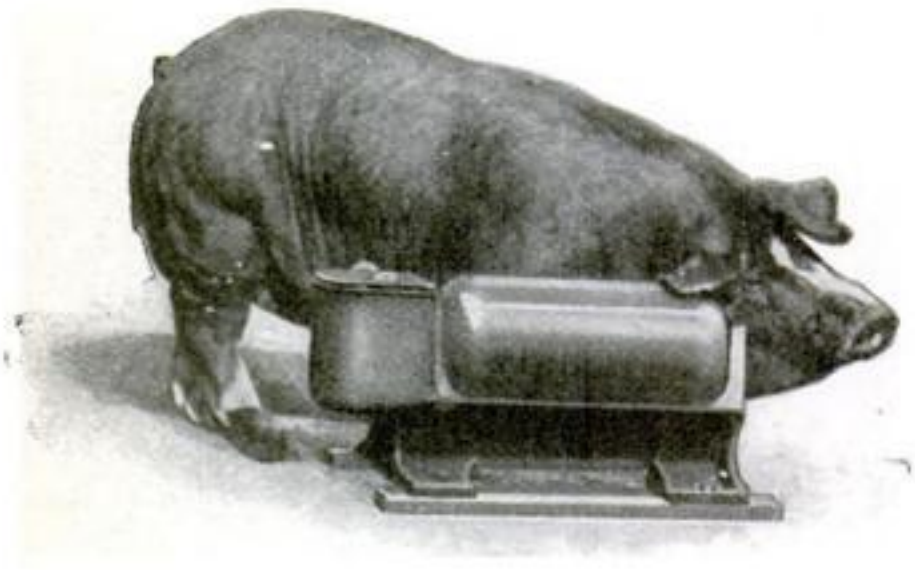
On the face of one hammer is a Maltese cross which is forced through the check when struck with the second hammer

Canceling Checks with a Hammer and Anvil

IN Cumberland County, Pennsylvania, one of the largest and wealthiest counties in the Keystone State, the Board of County Auditors still uses an ancient method of canceling all checks given in payment of bills by the county treasurer and by the treasurer of the Board of Poor Directors. The apparatus, shown in the accompanying photograph, generations old, is composed of a block of oak, fourteen inches high and ten in diameter, and two ordinary-looking hammers. On the face of one is a Maltese cross which is forced through the check when struck with the second hammer.

Hog-Power in the Hog-Pen

AN amusing sight can be witnessed on some of the large farms, where hogs in large quantities are raised, in the south and west. Large vertical gal-



The hog smears himself with an insecticide by rubbing against the roller

vanized-iron cylinders may be seen to revolve in the hog-pens, while the hogs, in numbers of ten or twelve at a time, trot busily around a cylinder, always in the same direction and sometimes at a speed nearly approaching a gallop. At first blush this procedure may seem like a recreation. But, the hogs are not playing at some new game; they are preparing their meal of ground grain, and the hog that is too lazy to trot and grind goes hungry.

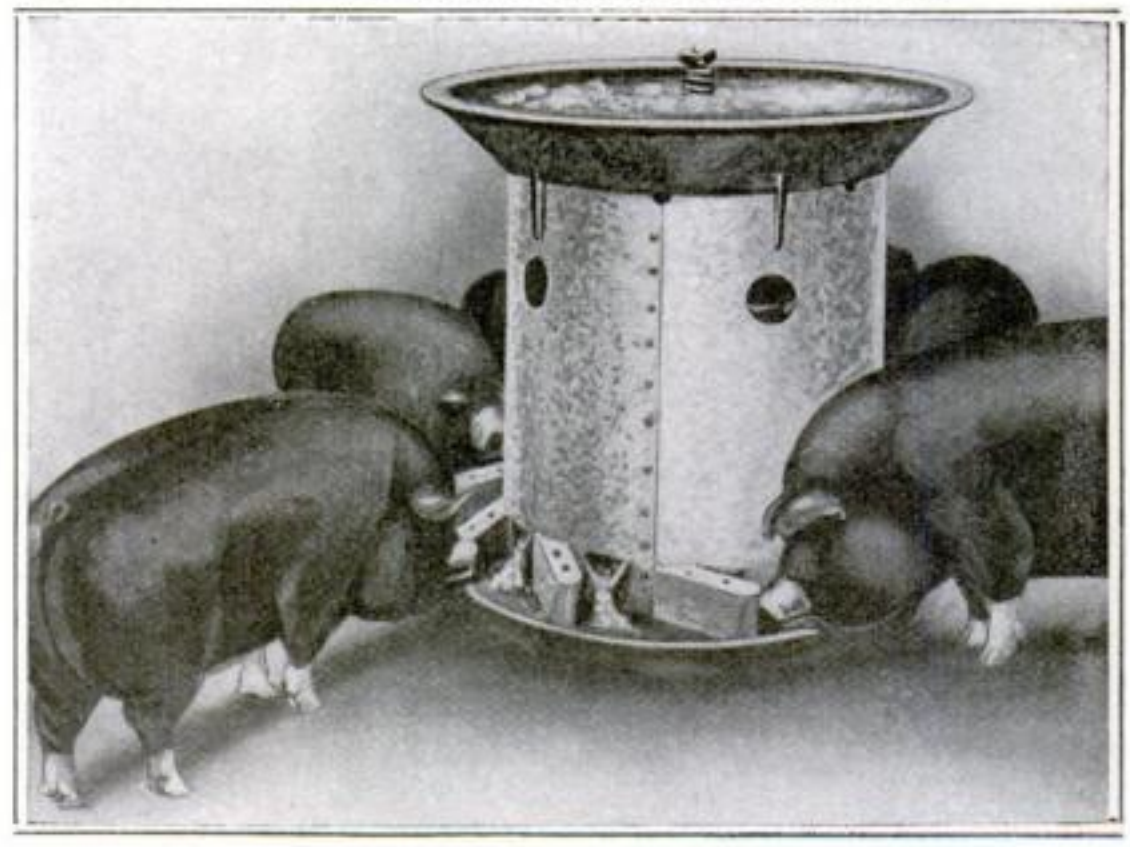
In the upper part of this revolving cylinder is a hopper or compartment into which the grain is poured. When the cylinder is revolved, a grinding mechanism chops the grain into fine particles suited to the palate of a well-bred hog. To secure this prepared grain the hogs must supply the motive power for grinding; and they supply it—with their snouts. A ring-like trough is attached to the bottom of the cylinder. Short wooden paddles project from the edge of the tank into the trough, and when pressure is applied to them they revolve the tank, grinding the grain, so that it flows in equal amounts into the spaces between the paddles. This grain feeder is virtually a "one-hog-power" machine as one energetic hog can revolve it.

Again, if you ever see a number of hogs pushing and jostling about a small device standing in the middle of a hog-pen, the object of their attentions may well be an apparatus which makes the hogs work to rid themselves of vermin, instead of forcing the farmer to spend weary hours spraying them with an insecticide.

The device consists of a steel roller set in a receptacle which is partially filled with an oily insecticide. The pigs find that when the vermin are troubling them, it is only necessary to rub against the roller, to end the trouble.

The appreciation of the hogs for these modern conveniences is absurdly comical in its actual working out, but these and similar hog inventions have done as much to make farming profitable in these modern days as many of the much more pretentious machines. The hog-pen takes up the slack end of the farm, and any devices which make them yet more independent of attention are vitally important. These appliances come the nearest to making hogs work of anything yet discovered.

Another apparatus by means of which the hogs apply insecticide to themselves and save time and trouble for the farmer



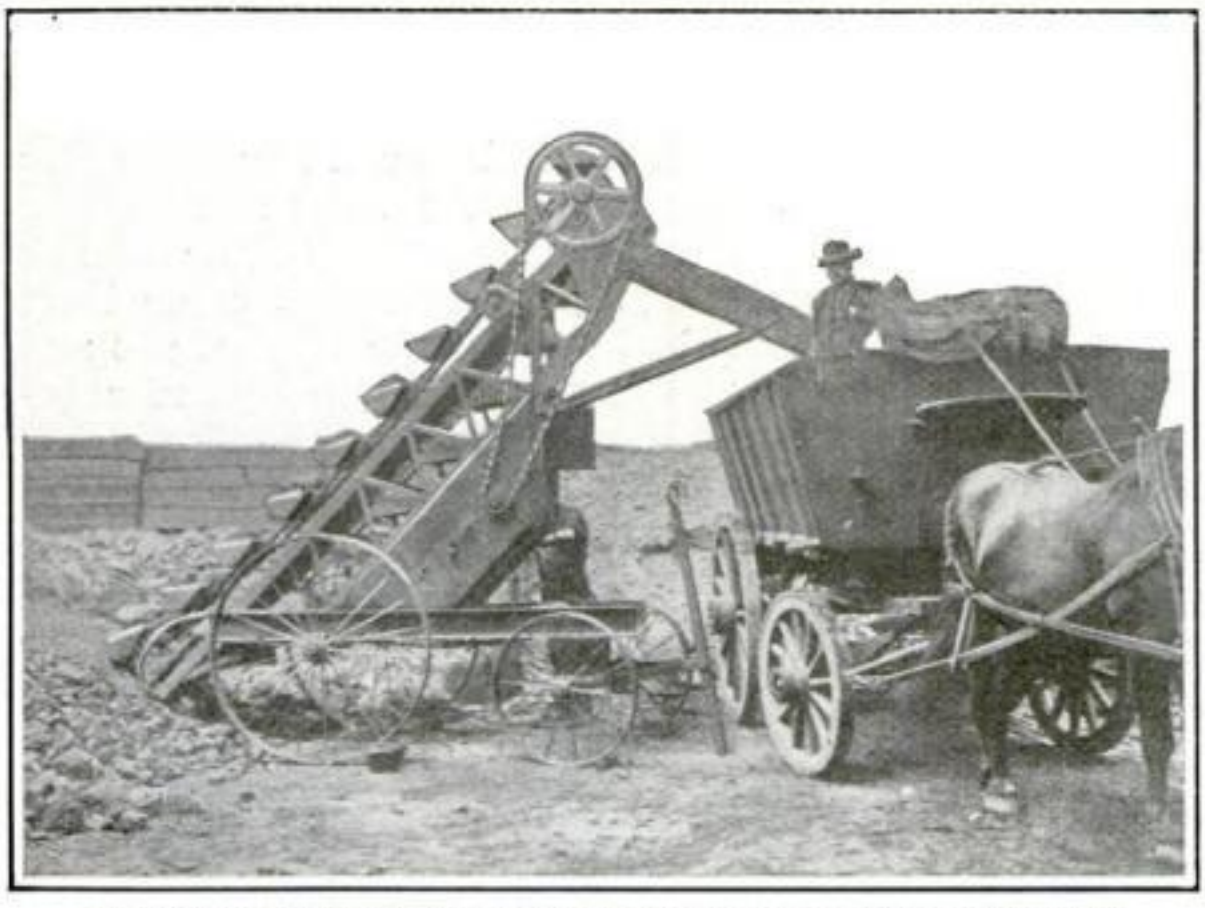
The hogs prepare their own meals by revolving the cylinder with their snouts. As the cylinder turns, it grinds the grain to feed the hogs. Lazy hogs go hungry

A Scientifically Designed Train-Announcing Megaphone

A GIGANTIC megaphone for announcing the arrival and departure of trains at the Pennsylvania Railroad's terminal in Washington, D. C., has been developed to such a degree of success that sounds emitted by it reach clearly to every corner of the huge station, despite the fact that the announcer is not required to raise his voice much higher than an ordinary conversational tone. The megaphone, which is mounted on a high wooden platform, is interesting, not only because of its gigantic proportions—for two men could crawl inside and hide comfortably—but also because it is the culmination, of a great many painstaking experiments.

A. M. Keppel, who is the designer, has tried out in the huge horn almost every applied principle of acoustics. A dozen horns of various sizes, shapes and groupings have been installed, improved and discarded. The present megaphone is considered to be the most satisfactory of all. Probably the most important discovery in connection with all of the devices tried was that a flat horn carries sound with fuller volume and less distortion than a round horn of the same general proportions. Accordingly, a huge flat megaphone was built and a number of smaller horns were secured within it, all being controlled by a single mouthpiece. As it now stands the horn contains no inner megaphones. Long iron wires have been attached, extending from near the mouthpiece to beyond the end of the horn. Their purpose is to prevent echoing, and to purify and clarify the sound. The giant megaphone measures ten feet four inches across the large opening and eight feet in length.

A megaphone which was built to carry sound without the waste of a single vibration



A loader which is built like a California gold-dredge and which can handle one cubic yard of crushed rock in a minute and a quarter

Wagon-Loader Resembles Gold-Dredge

A WAGON-LOADING machine has been brought out which in appearance and operation is a replica in miniature of the huge dredges used in California and Alaska for mining surface-gold. To a chain passing around two pulleys, one at either end of a steel frame, small steel scoops or buckets are attached at regular intervals. An electric motor supplies the power.

Why Can't We Make Diamonds

WE can. But they are so small that a microscope has to be used to see them. There is no chemical difference between the graphite in your pencil, the coal in the kitchen stove and the diamond. All are forms of carbon, and the diamond is but crystallized carbon. The Kohinoor that blazes in the diadem of a potentate was crystallized by nature from something like coal.

Molten iron will dissolve carbon, just as sugar is dissolved in water. Like water it chills and solidifies when it expands. A French physicist, Moissan, heated a crucible containing a mixture of pure iron and carbon to a temperature of seven thousand degrees Fahr. He dropped the white-hot crucible into cold water. The resulting contraction produced great pressure, and in that pressure diamonds were formed, not Kohinoors, but microscopic crystals, each of which cost about five times as much as a natural diamond of equal size. Sir William Crookes, the distinguished English chemist, obtained minute diamonds also by combining great heat with great pressure. He exploded cordite, to which carbon had been added, in a closed chamber. In other words he used a kind of cannon the mouth of which had been sealed. If we are to make big, salable diamonds we must have far more powerful mechanism at our disposal. Some day that mechanism will be provided, and the diamond factory of Niagara Falls will compete with the Kimberley Mines of South Africa.

A Lace Curtain Protection

IN the summer, when the windows are opened, the housewife may be annoyed by the fact that the lace curtains blow against the screens, and become rusty and dirty. This can be avoided by placing a small tack at each side of the window and tying a piece of white cord from one tack, across to the other. This will keep the curtains clean.

When a person sits near the window he may be bothered by the curtain blowing against him. Now, if another piece of string is placed exactly where the first piece was, and the curtain is placed between the two, it will be kept there; and both difficulties will be solved.

Eliminating Pottery Waste

POTTERY-MAKING has been, until recently, one of the few remaining industries where the skilled workman held absolute sway. And even with the most skilled of firemen, the variation in the degree of heat in the kilns was still so great that the loss in ruined pottery and "seconds" was immensely high.

Not long ago an Englishman, Conrad Dressler, invented, for use in the glazing of wall tiles, a tunnel-kiln in which small carloads of material could be fired at once, and in which, by means of the generation of the heat from gas-producers, a saving in fuel up to eighty per cent could be affected. Not only this, but the temperature was kept so even that the wastage from ruined tiles and "seconds" was eliminated almost entirely, and the whole device could be controlled by unskilled workmen.

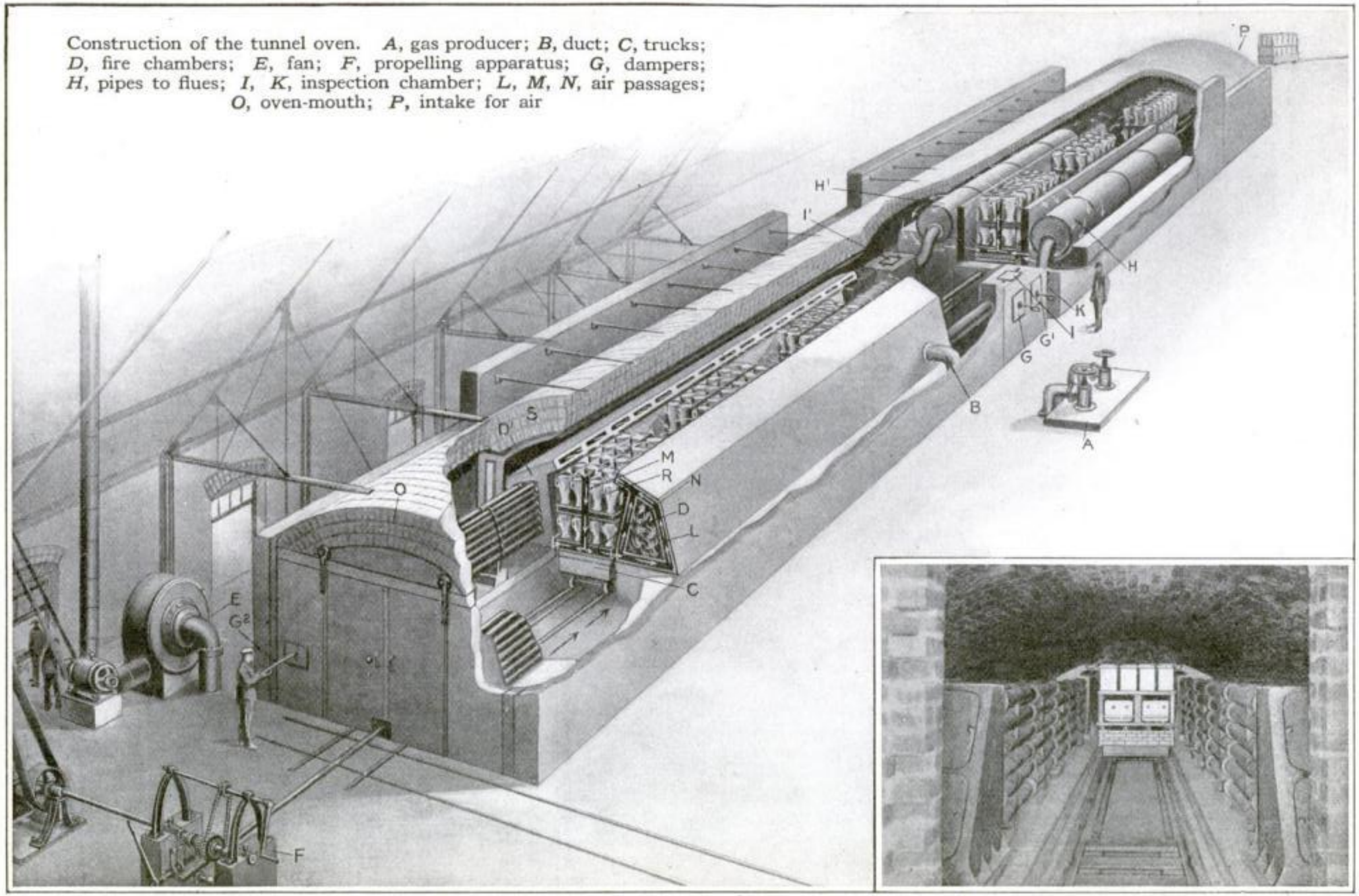
The oven has recently been applied to the kindred art of pottery-making, and in several large plants has taken the place of the old ovens, with vast saving to the company, though perhaps delivering a blow to that notable American industry, the five-and-ten-cent-store, where "seconds" delight the economical.

In pottery the clay bodies are changed in chemical and physical structure at a temperature varying from two thousand to twenty-five hundred degrees Fahrenheit, and to fall short of this temperature or to increase it unduly for any length of time, is to spoil the merchandise.

The gas from the producer enters the tunnel-kiln and is burnt, not among the wares to be baked, but in two long tubes running lengthwise of the tunnel, from which the fumes are carried off outside the kiln. The control of gas and air for its combustion is regulated automatically or at will, and is thoroughly even. The goods to be fired are put on the trucks, and propelled by a small motor, taking about one hour for the trip, not including the cooling in a heated chamber.

This kiln was first used in this country by a manufacturer of sanitary porcelain ware, and the scene reproduced here is from this American plant. The goods, in all cases, are placed on the shelves of trucks, which commence at two feet from the ground and rise to five feet for their trip through the long kiln.

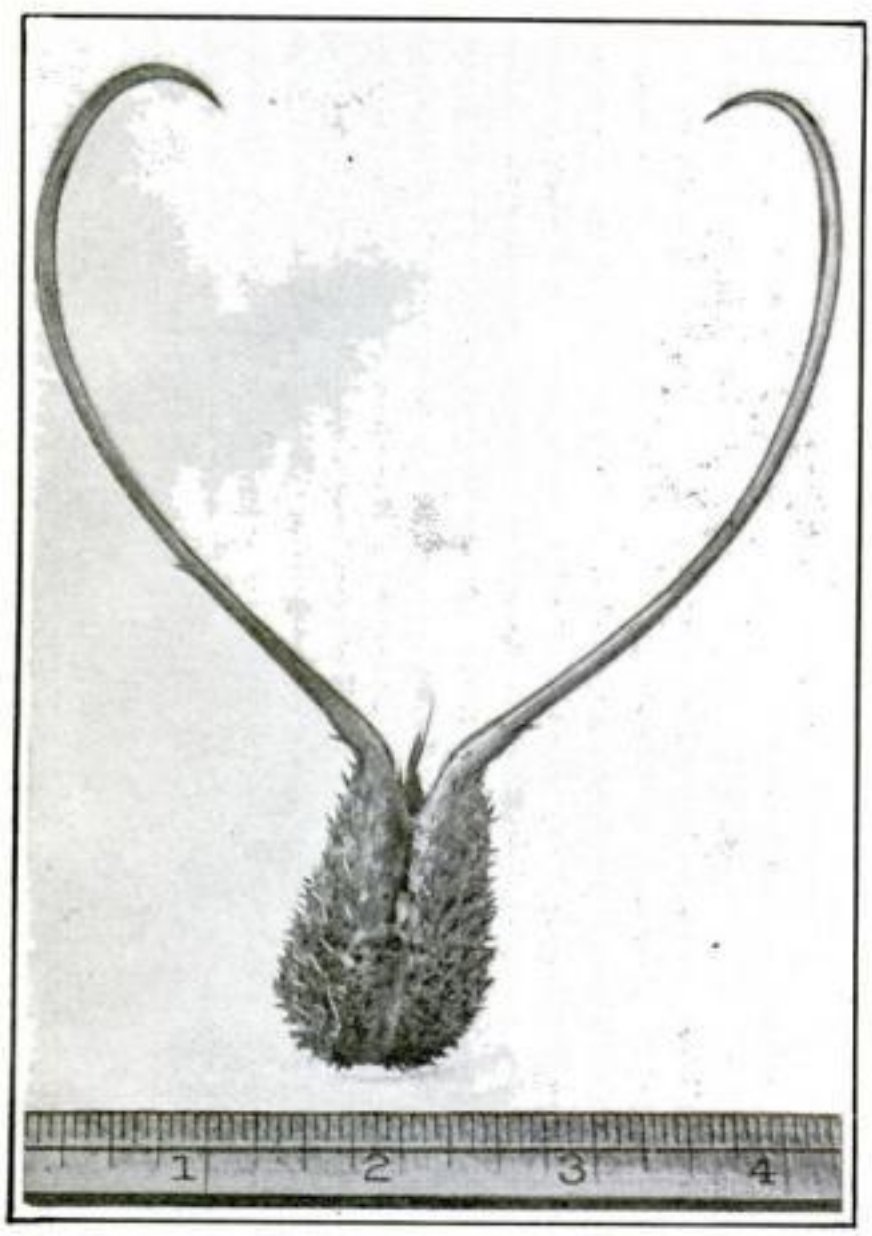
Construction of the tunnel oven. *A*, gas producer; *B*, duct; *C*, trucks; *D*, fire chambers; *E*, fan; *F*, propelling apparatus; *G*, dampers; *H*, pipes to flues; *I*, *K*, inspection chamber; *L*, *M*, *N*, air passages; *O*, oven-mouth; *P*, intake for air



A Pottery Furnace built like a railroad terminal with real cars and tracks

A Fiendish Plant Which Thrives on Cattle

A PLANT grows in Persia, which kills by burying itself within an animal's nostrils or sides, the seeds there germinating and imbibing the moisture



A plant which fastens its claws into the nose or sides of cattle, kills them and feeds upon them

from the decaying body. No rain falls on the mountain plateaus of Persia during the whole summer. Vegetation is luxurious in the spring, when water in abundance runs down to the plains from the snow-covered mountain-chains and ridges. A merciless sun, and a dry desert atmosphere soon evaporate what moisture is not carefully stored by artificial means, and all plant life withers and dies, except desert thorns and some species of thistles.

During the spring the fat-tailed sheep and the camels enormously increase the fatty deposit in tail and hump. In two months' time bees store up honey enough for the rest of the year. All nature seems to labor overtime.

When the spring luxuriance of verdure is passing, our fiendish plant begins its deadly work. The fully developed seed pods, hidden under the withering foliage of brown and yellow leaves, fasten their tiger-like claws in the nostrils of a grazing camel, a wild ass, an antelope or a sheep; the animal tries to rid itself of the sharp prongs by rubbing, but the more it rubs the deeper it forces the claw-like tentacles into its tender, tortured skin. In many cases inflammation of the entire throat follows and the poor animal, unable to eat or drink, succumbs. That appears to have been the object of this fiendish plant, for it seems that only in the rich fertilizer of a decaying victim can it find enough nourishment for numerous offspring, which sprout from the hundreds of black seeds contained in its great, belly-like capsule. This is what the drivers of caravans say, and they hold the plant in fearsome awe, giving it many a bad name in their native tongue, such as "devil's flower," the "killer," and the like. The herds of breeding camels are left on the grazing grounds in a semi-wild condition, and wander over many miles to find sustenance.

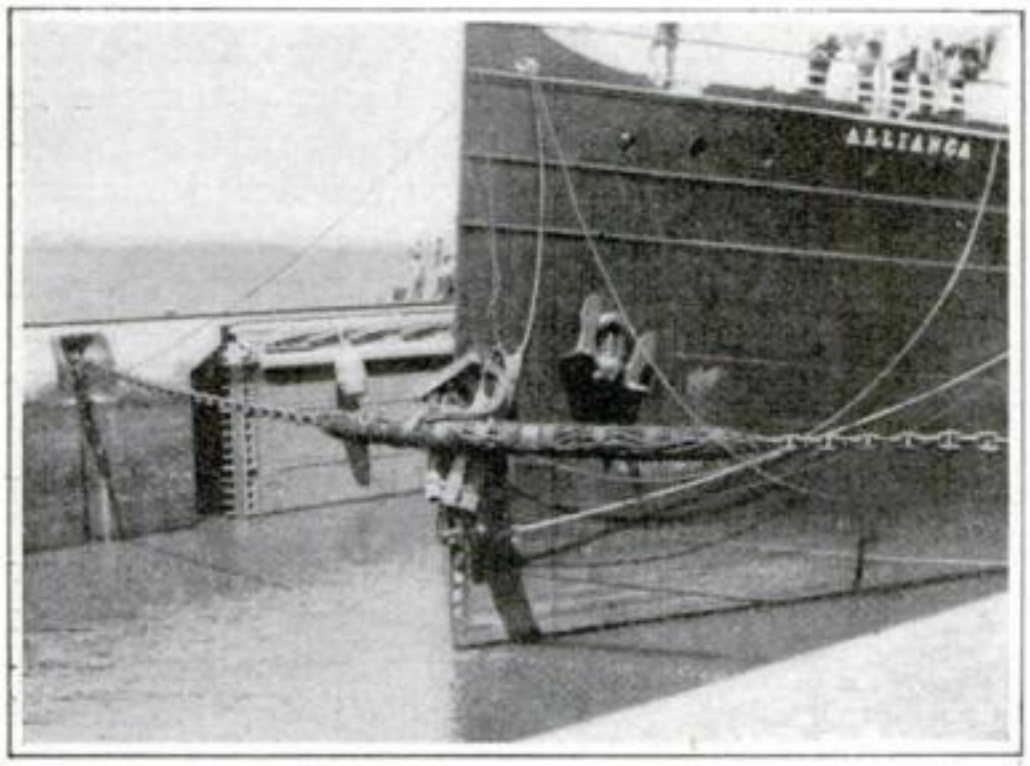
With a wheel on the front, a canoe can be handled easily by a woman or child

A Wheel-barrow for Canoes

A CANOE-BARROW, invented by a Philadelphia man, makes the transportation of a canoe on land an easy matter. Even a woman can take a canoe down to the water with the barrow. A wheel is attached to a simple metal frame that engages the gunwales and bang-plate of the canoe at one end. It may be attached to an empty or loaded canoe while resting in its natural position on the ground.

Panama's Locks Guarded by Chains

THE huge locks of the Panama Canal are guarded by massive chains stretched across the channel. No vessel can crash into the gates at any of the locks because of these fenders, placed seventy feet from each gate and near the surface of the water. When a boat is allowed to pass, the chains are lowered to the bottom of the canal. If the chains are struck by a boat, they gradually yield to the force, paying out to a certain distance which depends upon the violence of the impact.



Great chains act as fenders to keep ships from smashing into the locks at Panama

The mechanisms which regulate the chain-fenders are installed on either wall. A system of hydraulic cylinders is used for raising and lowering the chains. The action of the fender when struck by a boat is modified in part by the friction produced in the machinery, but mainly by the resistance produced by water flowing through valves.

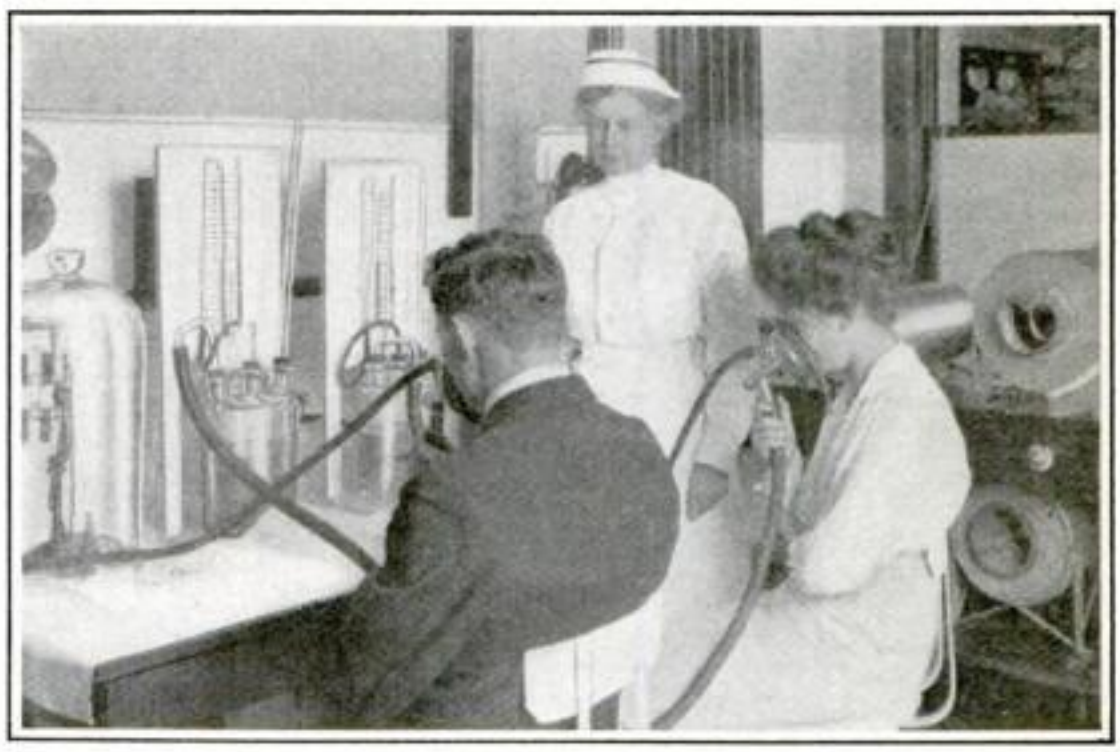
Satisfactory experiments were conducted last November under the direction of Henry Goldmark of New York. The *Cristobal*, laden with her cargo from New York, was run against a chain at various speeds and was brought to rest without injury. The distance traveled after striking the chain agreed, in each case, with the previous calculations.

Three-Quarters of Humanity Are Deficient in Lung-Capacity

RECORDS show that fully three-fourths of us are deficient in lung capacity. Regarding six as a normal standard, the average person is able to register only three or four units of pressure. In cases of asthma, the lung capacity is only one-sixth normal.

Bronchial affections such as asthma, hay fever and similar disorders are readily benefited by the therapeutic use of the vacuum breathing-apparatus. The mechanism is not complex in its operation, the chief end to be attained being the gradual increase of the breathing capacity of the patient.

The patient places a rubber hood over his nose and mouth so that all air reaching him must be drawn through the rubber tubing. This tubing is connected with a glass containing water, which is permeated by air obtained through another, independent opening. The patient is forced to draw the air he breathes through the water, or against an approximate pressure of six pounds. This makes him breathe deeply and vigorously. Exhalation is made easy by the pull of a vacuum apparatus operated by motor, connected through a second tubing with the breathing hood. The lung energy expended is indicated on a mercurial register.



A vacuum breathing-apparatus to increase your lung power by drawing air through water

Maud Muller Up to Date

THE hay-rake has been vastly improved since Maud Muller's poetic hay-day. It is the ultra-modern machine that the lady in the accompanying picture is operating. Like a good rule it works both ways. As a rake it covers a wide path and delivers the hay in a row at one side. It has a rotating tooth-carrying frame, the rotation of which may be reversed at will. When reversed, it operates as a tedder, that is, it kicks the hay into the air, thus turning it over so that green hay will dry quickly.

Maud Muller now gathers the hay with a modern rake, which delivers it at one side in neat rows for loading

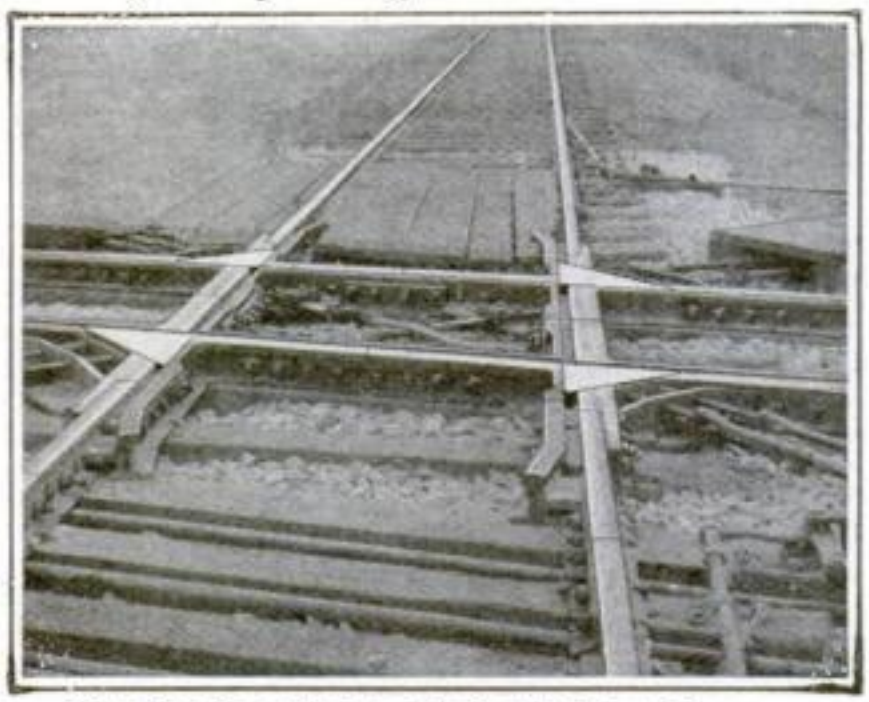
The angle of the teeth is automatically changed by reversing the rotating frame. In consequence, the teeth are always disposed at the proper angle when the machine is in operation. This makes the machine effective, however unskilled the operator may be.

The rotating frame is controlled by a somewhat intricate set of gears operated from a hand-lever within reach of the driver. It is a great help in haying time. Lewis E. Waterman, of Rockford, Illinois, invented the various improvements that distinguish it from other side-delivery rakes.

A Continuous Railway Crossing

A CONTINUOUS crossing has been invented that has very few parts and which makes the passage of every train perfectly smooth either way. It is composed of four steel triangles which slide back and forth by means of a lever thrown in the switching tower. In the illustration may be seen the four triangular blocks and also the rods which are used in operating them. When the blocks are set to make a continuous crossing from left to right and it is desired to clear the other track, a stroke of the lever will cause the blocks to move in a diagonal direction upward and outward. The slots are thus closed, making continuous rails for the trains. This system may be attached to the signal system so that it is always in the correct position.

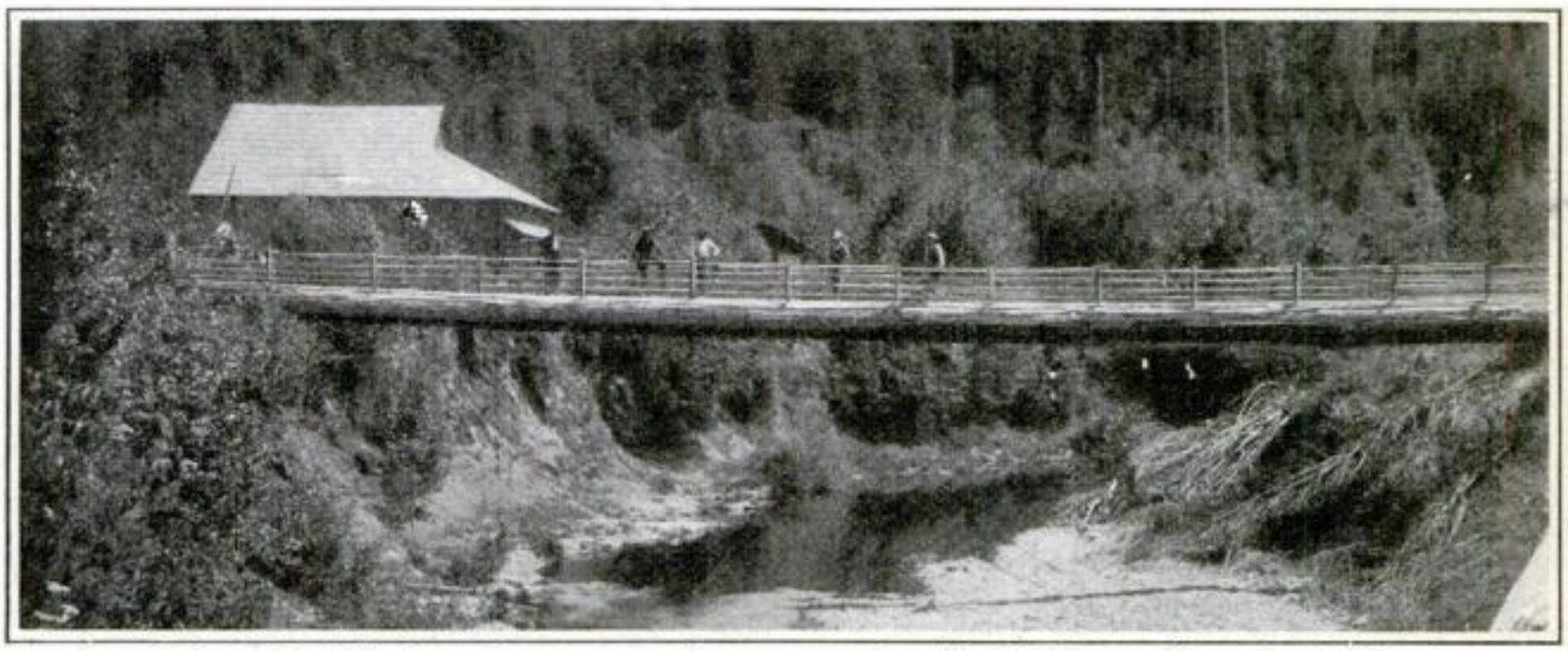
The new device has been installed for test purposes by the Pennsylvania Railroad at Carrothers, Ohio, where sixty trains pass every day and the wear on the crossings is so great that new ones are necessary frequently. This crossing, however, has given excellent service for a number of months and may be permanently adopted. Trains of sleepers, ordinarily as noisy as trains of freight cars, pass over quietly without waking the passengers.



The jog is entirely eliminated by this new railway crossing

A Tree Which Serves as a Bridge

CUT near Marshfield, Oregon, in the celebrated Coos Bay region, a fallen forest tree is made to serve the useful purpose of a foot-bridge. The tree—an immense fir—grew handily enough by the side of a stream, to bridge which under ordinary circumstances would have cost considerable. Once the interested residents hit upon the idea, it was practically no trouble to fell the tree across the stream, trim away the branches and with an adz to flatten the upper surface of the fallen trunk. To make passage over this unusual bridge less hazardous, a hand rail was built through the simple expedient of boring holes in the log for the upright standards to which the fence-like railing was attached. The bridge gives complete satisfaction and attracts the interest of every newcomer in the vicinity.



A giant fir, felled to drop across the stream, furnished this excellent foot-bridge

The Ozark Float-Boat

AMONG the types of small craft that navigate North America's inland waters, one of the most peculiar is the Ozark Mountain float-boat. The swift, crooked and rocky streams of southern Missouri and northern Arkansas have known it for many decades, but at last it is beginning to disappear before the invasion of canoes and small power-boats. Under the management of a native "hill billy" the float-boat is as tractable as a family nag, but when a city man tries to ride it the craft sometimes behaves more like a broncho.

In appearance it is most primitive. "Something like a dug-out, something like a canoe, something like a flat-bottomed skiff," describes it—yet it is no more than a cousin to any of these. It is made of a few pieces of lumber held together with iron clamps, fashioned by the cross-roads blacksmith; in length is twenty feet or more; in width, not much wider amidships than two. It rarely has any seats and scarcely ever knows paint. The sides and ends taper like a canoe's, but the bottom is flat and the passenger, if he is careful, may stand up in it when he is casting for bass.

The craft is called a float-boat because its specialty is going down stream. When it has to be propelled against the current the native lays down his paddle and takes to poling.

The Ozark float-boat is rough, but it is as tractable as a family nag in the hands of an expert

A Medley of Puzzles

By Sam Loyd

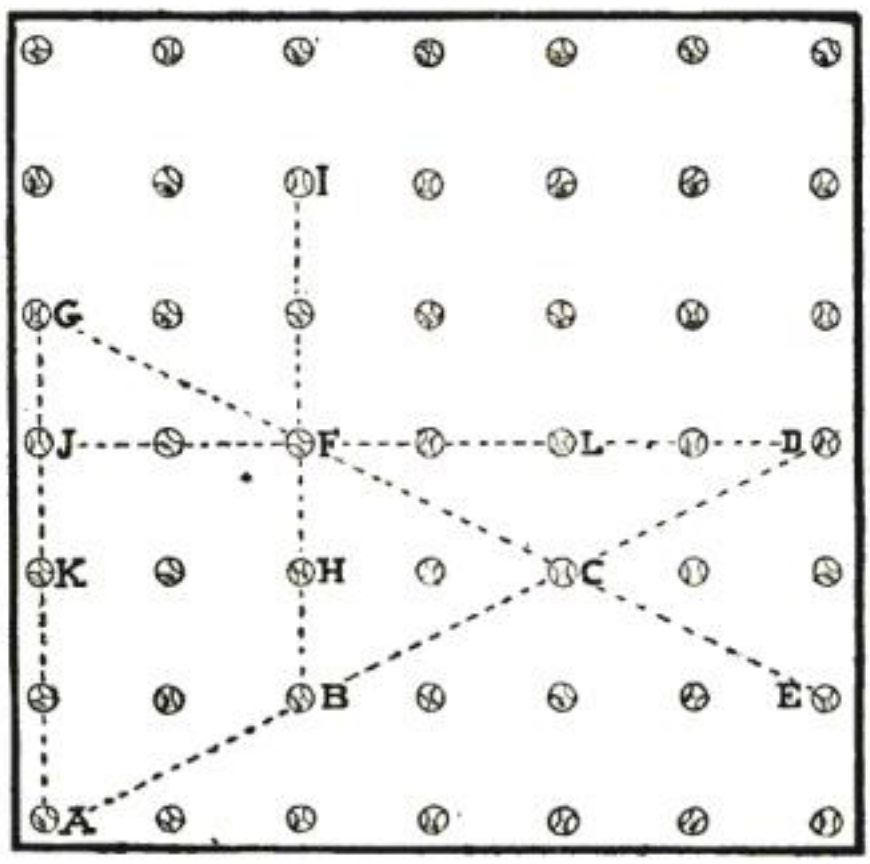
Fifteen Dollars in prizes will be awarded for the solutions of the puzzles appearing on these two pages. The first prize of Five Dollars will be awarded to the reader who sends in the best set of answers and writes the best letter of suggestion for the Puzzle Page. The letters of suggestion must not contain more than fifty words. Ten prizes of One Dollar each will be awarded to the ten readers who send the ten next best sets of answers and letters.

Answers to the May prizes will appear in the June issue. The names of winners of the prizes in the July issue. Answers and letters must be received before May 8th, addressed to Sam Loyd, care Popular Science Monthly, New York.

Play Ball

IN this field of 49 baseballs the puzzling proposition is to mark off all but 20 and to leave those 20 balls in such arrangement as to score the greatest possible number of rows, 4 balls to a row.

In the diagram it is shown how the balls, lettered from A to K—12 balls—are made to score 5 rows. Now see what is the highest score you can make with the full complement of 20.



How Large Is This Man's Lot?

"Talking about Poles" remarked McManus, "here's a study in Poles that would give Peary and Cook a pair of headaches.

"In building a fence around my square lot I find that if I put the poles two feet apart I will be shy 110 poles, whereas, if I plant them two yards apart, I will have 90 poles left over.

"Now can you tell me how many square feet there are in my lot?"

Children A-plenty

Farmer Smith and his wife say that the race suicide scare is of no account down their way, as they have 15 children, born at intervals of one year and a half.

Miss Pocahontas, the eldest of the children, who is reluctant about mentioning her age, admits she is seven times older than Captain John, Jr., the youngest of the brood.

Can you assist the census man in figuring out the age of Miss Pocahontas?

MARCH PRIZE WINNERS

The ten copies of the "Cyclopedia of Puzzles," offered for the best answers to the four March puzzles are awarded to the solvers given below, who not only solved all of the puzzles with absolute correctness, but gave analyses of the Kugelspiel problem, which proved to be the stumbling block for most of our contestants.

Ernest A. Hodgson, Dominion Observatory, Ottawa.

Nathaniel Ratner, 1804 Arthur Ave., Bronx, N. Y.

Fred A. Tracey, 59 White Street, Mt. Holly, N. J.

T. B. Ford, Chevy Chase, Md.

George S. Fuller, 506 Sears Bldg., Boston, Mass.

Chrystal McCue, Goodells, Mich.

Audley A. Baker, 808 Bell Ave., E. Carnegie, Pa.

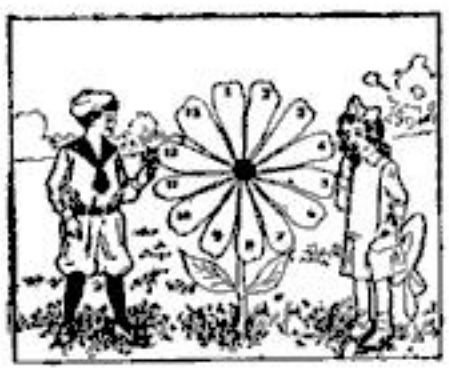
Earl F. Koke, 2121 N. Nevada Ave., Colorado Springs, Colo.

Wm. K. Bendrat, 616 W. 48th Street, Los Angeles, Calif.

J. A. Fairchild, Mt. Olive, Ill.

A Daisy Game

Here is a version of the "One I love two I love" Daisy Game which involves a neat little puzzle. You see the young people take turns in plucking the petals, the victorious player taking the last petal and leaving the "Old Maid" stump with his or her opponent. The player has a choice of removing one or two of the petals at each play, provided the two are side by side. For example, the first player might take petal 13, or 1 and 2, but not 2 and 13, since they are not together.



The game may be played with small buttons or other markers laid upon the petals until all are covered. If your opponent started by covering 1 and 2, what would be your play to make sure of a win?

While You Wait

O'Sullivan, the cobbler, who shoes his customers "While you wait," says he can repair five pairs of men's boots in the same time that it takes to fix six pairs of women's shoes, and that it takes the same time to overhaul five pairs for the children as it does three pairs for the women, so he charges according to the time consumed.

The other day he took in $6.60 and reshod three men, four women and two children. Can you tell how much he charges to repair a pair of children's shoes?

Reversing Magic Squares

"Let us have a little talk about magic squares," said the schoolmistress. "The arrangement of numbers in the form of squares, so that they will add up the same amount in every column, as well as in the two diagonals, is without doubt the oldest of mathematical puzzles. It was held in great veneration by the Egyptians; and the Pythagoreans, to add more efficiency and virtue to the magic square, dedicated it to the then known seven planets.

6	1	8
7	5	3
2	9	4

"Here we have the simplest form of the magic square, this being capable of extension ad infinitum. Now, since there is nothing new to be presented about magic squares let us take a contrary view of the magic square principle and imagine an arrangement of figures in square form that will not give two like totals in the 8 rows. Juggle the figures about in any manner you wish to bring about the 8 different totals, but do not disturb the center 5.

"There is another little puzzle suggested by the lines forming the squares.

"I want you to show how the diagram of 9 little squares may be constructed of 4 separate continuous lines of similar length, which means that no lines must cross. There you have two puzzles to work out."

APRIL ISSUE PRIZES

The Editor has decided that it is not fair to award the prizes of the Puzzle Page on a basis of the date of mailing the answers because readers do not all receive their copies at the same time. Therefore the prizes for answers to the puzzles in the April issue will be awarded in accordance with the rules stated on the opposite page governing the prize offer for the letters and answers to puzzles in this issue. Answers to the April puzzles must be received not later than May 8th.

The answers to the April puzzles will appear in the June issue. The names of the successful April contestants will appear in the July issue.

Blasting for Good Roads

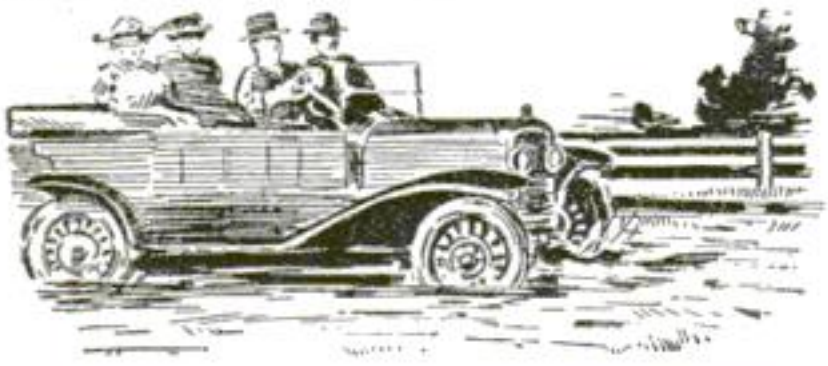
By J. H. Squires, M.S., Ph.D.

SOME corrective must be found for the present poor condition of roads that are already oppressive and promise to become intolerable.

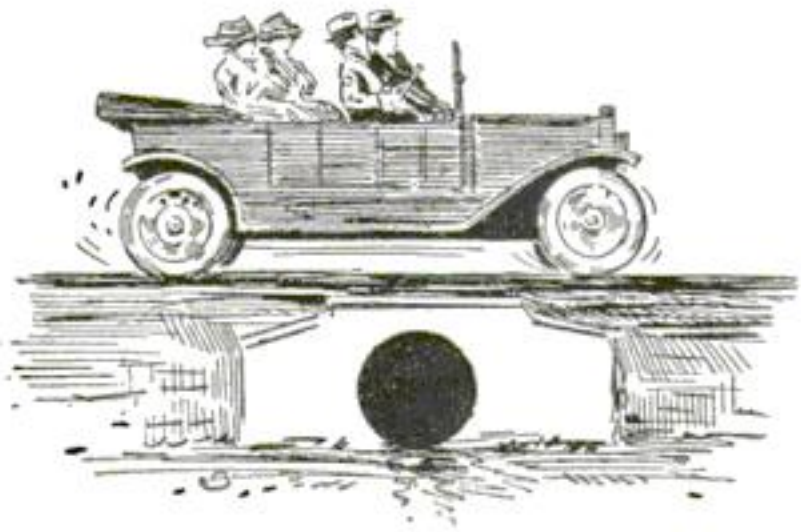
As for the work of building or improving roads, the advent of dynamite into this field is reducing both time and labor to a minimum. For clearing a right of way by removing stumps and boulders, removing outcrops, getting rid of high sides and digging ditches—for proper drainage is the best of good roads insurance—it has been demonstrated that the highest point of efficiency is reached through the use of explosives.

Also for cutting away hillsides or bluffs and lowering grades—operations which heretofore have in many instances seemed prohibitive because of the labor required—this modern short-cut to the easy haul is destined to bring about a radical change in our roads.

For both the construction and maintenance of good roads, it approaches the ideal, since it reduces time, labor, and expense, and produces results that make for permanency.



Swamps and uncontrolled streams are hard on vehicles



The condition revealed in the upper picture corrected by a blasted ditch and a good culvert

Bad drainage is the greatest enemy of good roads. Excess of water, more quickly than anything else, destroys a road. Relief is through drainage. Drainage ditches were formerly dug by hand labor; the cost was high and the work progressed slowly. Many are already more or less familiar with ditch blasting methods and the results that are obtained. In the rougher sections of the country, especially in the swamp and flooded areas, the use of dynamite for ditching cannot be too highly recommended. It does the work quicker, better, and cheaper. It permits good drainage at a low cost where any other method now known would mean poorer drainage and a great increase in cost. This applies to all types of ditches.

Plan of loading preparatory to blasting a ditch through a swamp

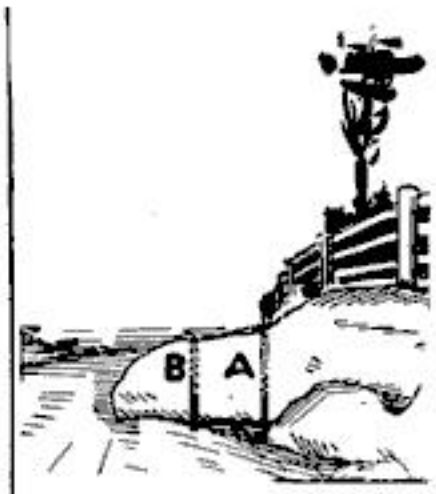
Boulder in ditch flooding a road

Proper method of placing and loading a boulder for smoke-hole shot

Excepting in some prairie regions, all road improving is attended with much stumping in or along the right of way. Most stumping on highway construction is now done by hand. The work is slow and expensive; the stumps are heavy and difficult to handle and are therefore simply rolled to the side of the road, where they remain as eye-sores for years. These stumps can be blasted out at small cost.

There is now much pick and bar work in removing boulders and ledges from the road. A careful study of conditions

A common obstruction



Fire "B" before "A"

The rock broken up

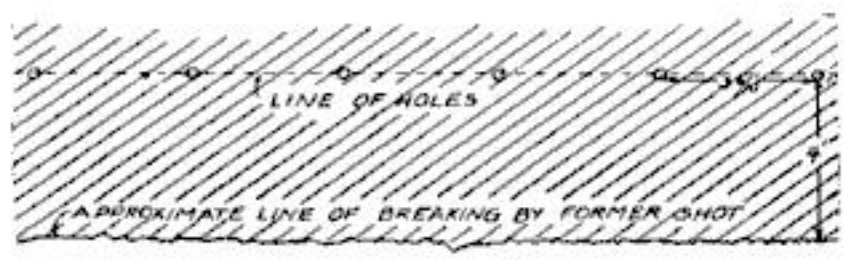
The clear road

has failed to reveal a case where the use of explosives will not hasten the work and decrease the cost.

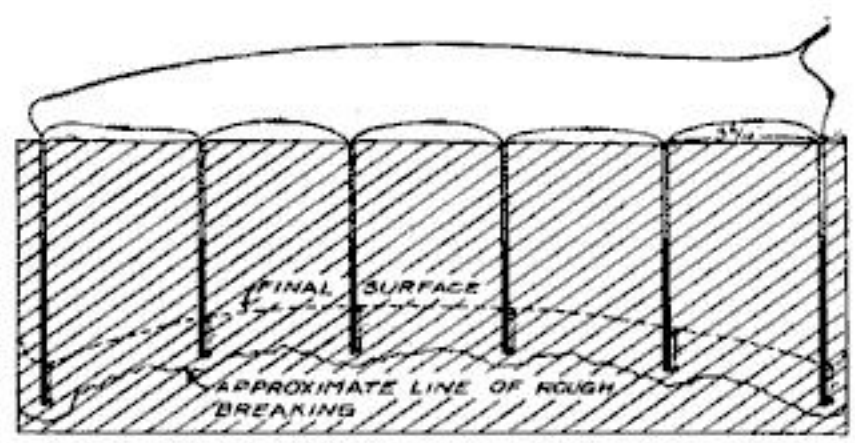
The old method of making cuts in hard ground by hand digging, using road plows for loosening the clay, is not at all satisfactory. It is slow, arduous, and expensive. Well placed blasts will either loosen or throw down this hard ground so that it can be easily loaded into wagons or carts, or can be removed by drag or wheel-scrapers. The object sought is the saving of time and expense.

When road improvement necessitates the widening of cuts, the work is too often done with picks. The hard ground is loosened and torn down by hand digging, and then carted away. Material saving in time and money may be effected by throwing down the banks by blasts, after which the loosened soil may be moved with scrapers or by wagons. The exact nature of the loading will depend on the depth of the cut and the nature of the ground to be moved.

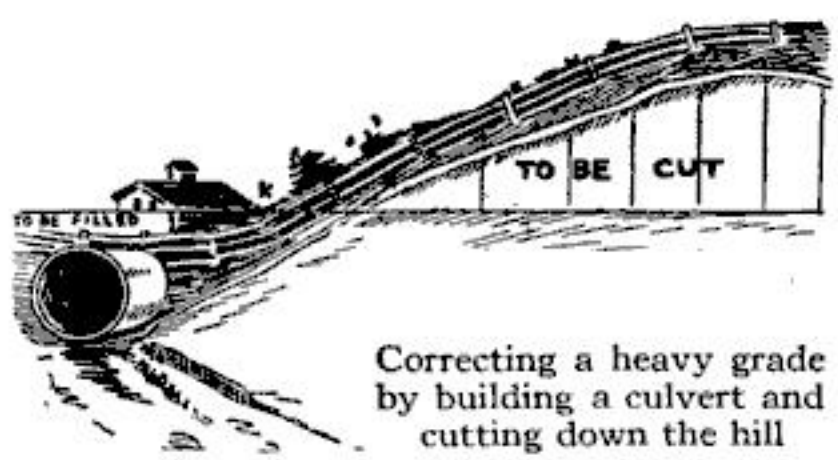
The high side in a road which is caused by a boulder or hard bank on one side, or by the washing away of earth on the other side, is now too often left as an impediment to progress. Light blasts are proving effective for loosening this material so that it can be removed by a drag scraper or road machine.



Plan of appropriate loading for cut work



Elevation of approximate loading for cut work



Correcting a heavy grade by building a culvert and cutting down the hill

The stumps, boulders and ledges in the side ditches are now largely neglected. This causes baddrainage. Their removal can be successfully accomplished only when explosives are used.

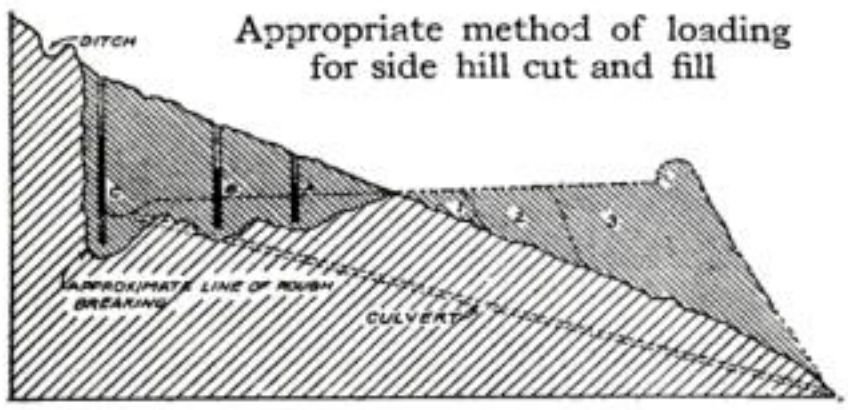
Old water breaks or "thank you marms" are also attacked by explosives, as blasting is most effective in getting rid of these.

Many of our hill roads are now troubled with short, dangerous curves where skidding and collisions are always to be expected. Too little attention is given to correcting the conditions. The new dynamite method of relief is to shoot off the point of the cliff if the road passes around the outside point, or to widen the side hill cut if the curve points into the hill. The bank may be shot away by heavy charges that will blow all of the soil down the hill, or the ground may be loosened and removed by scrapers or road machines.

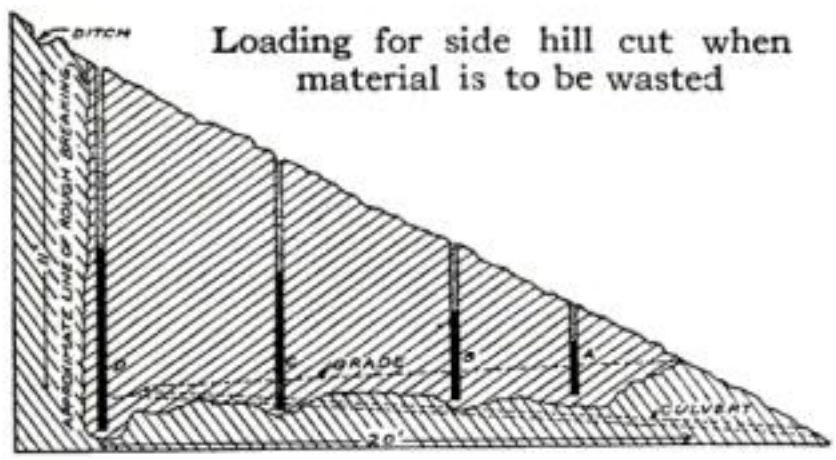
Much interest is now being shown in tree planting along private and public

roads. These trees must usually be planted where the conditions are not favorable to them. Where such adverse conditions are encountered, better results in the growth of the trees are obtained when each hole is blasted.

In heavy road construction the steam

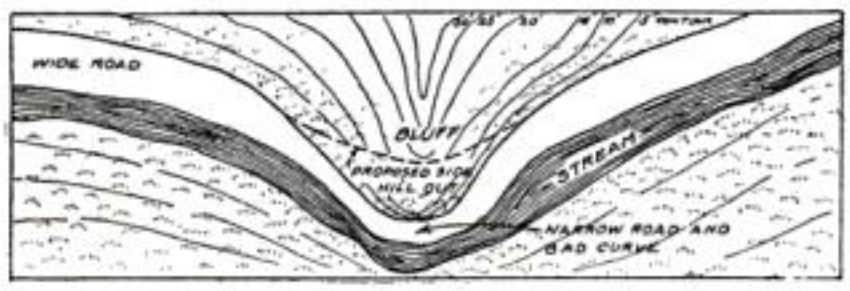


Appropriate method of loading for side hill cut and fill



Loading for side hill cut when material is to be wasted

shovel is playing an important part. Light tractor rigs are employed. These dig slowly and with difficulty in hard ground. On actual count it was found that under such condition the dipper was not filled more than one time out of



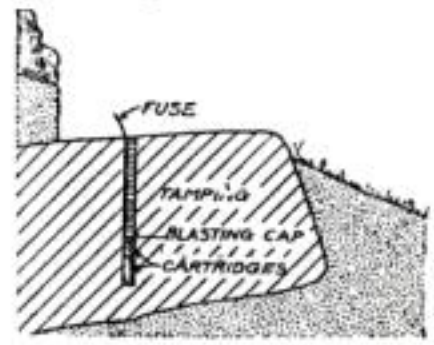
A common road trouble and the remedy

five. This slowed up the work. Blasting ahead of the shovel will loosen the ground so that it can work to capacity.

The demand for hard surfaced roads creates a need for millions of tons of crushed stone. This is blasted out of the quarries. In some sections remote from operating quarries, the stone is obtained by blasting hard boulders out of the fields. Occasionally a rock cut affords an excellent source for stone, and gives the additional advantage of cheapening the cost of construction by making use of the most expensive material to excavate.

When crooked or shallow streams are paralleled or crossed it is often cheaper to correct the stream than to elevate the road to a sufficient height to keep it out of trouble.

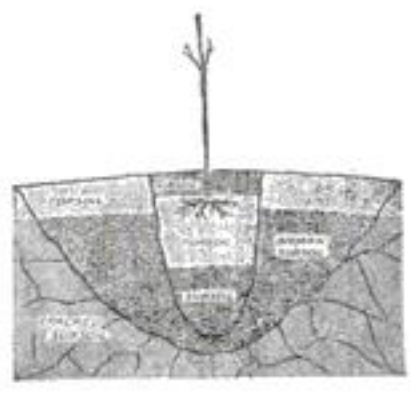
A great part of the filling up of stream courses is caused by logs and other floating material forming rafts and sand bars in the channels. Another fruitful source of trouble is from outcrops of rock which divert or impede the normal flow of the current. Overhanging stumps and trees along the banks lend still further obstruction. Sharp bends in the course of the stream check the current and cause trouble by forming sand bars.



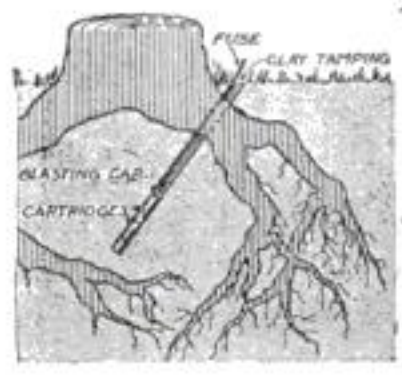
Loading a rock-ledge outcrop

Any and all of these troubles may be overcome quickly and at reasonable cost by the use of dynamite for shooting out the rafts and logs, and blasting a sufficient channel through the confining rock. A well-placed blast will cause the overhanging stumps to vacate immediately.

Cutting off sharp turns in the channel will take a little more time and should be well done in the beginning. Locate the line of the new cut-off and blast a ditch that will at all times carry a part of the flow. When this is done and the rafts and logs are out of the way above and below, all there is left to do is to wait for heavy rains to flood the streams. The increased velocity of flow will cause the water to cut and wear away at the bottom of the channel as well as at the sides. From time to time it will be best to go over the stream and make sure that no new obstruction is being formed.



A good use for blast-holes

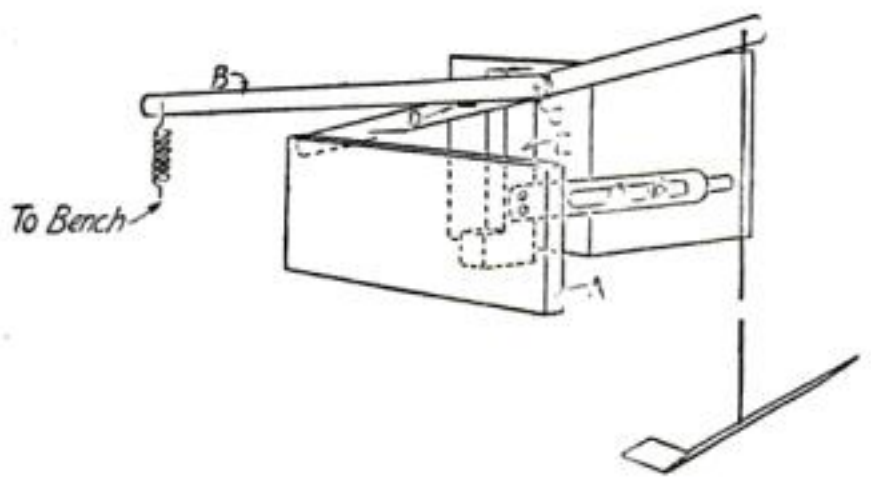


Loading top-rotted stump

Small blasted ditches have been scoured out by the current until they are now carrying the entire flow of large streams. With a little help now and then any stream with a fair fall can be made to do wonders in making itself a permanent and suitable course.

Sometimes roads must parallel streams for considerable distances, where the lay of the land is such that the road must be immediately alongside the stream. Correction lies in deepening the stream by blasting, and then constructing a small side ditch next to the bank to handle the water from above.

The field of usefulness of explosives in road building is rapidly widening and will in a short time include many classes of work now done entirely by hand labor, as the cost will be materially reduced.

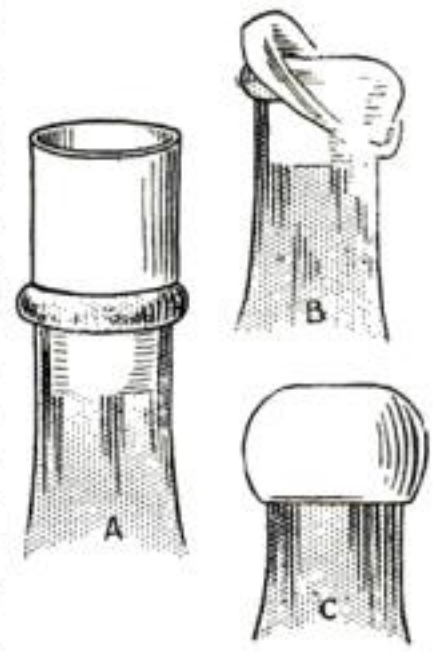


Construction of a bench shear for cutting copper strips. This device is easily operated by a foot treadle

Making a Bench Shear

THE illustration shows a shear that was made for cutting strips of copper, ½ in. wide and 1/16 in. thick. The jaw *A*, is made deep to be gripped in the wire at the bench. The moving jaw is connected to a treadle on the floor. The rod *B*, which brings the moving jaw back to place, pivots at *C*, and rests on the pin *D*. It is worked by a spring which is fastened to the top of the bench. The guide *E*, which is fastened to the stationary jaw, keeps the two cutting edges of the jaws together. The stop is made adjustable, as shown. The jaws should be made from tool-steel. The writer made the stationary jaw out of cast-iron, which has cut several hundred pieces and is still in good condition.—C. ANDERSON.

An Improved Bottle Stopper



A BOTTLE stopper especially suited to the use of travelers, is shown in the illustration. It consists of a single piece of soft red rubber, having two parts, a base and a hood. The base is in the form of a regular stopper, and its upper edge is extended as a short tube, as shown at *A*, in the illustration. After inserting the stopper in the bottle, the top part is pulled down over the rim, as at *B*, forming a tight hood over the mouth of the bottle, as at *C*. This stopper is especially good for benzine, alcohol and other volatile or inflammable liquids, or for acids and the like.

New Automobile Alarm Calls for Help

THE recent starting of an automobile at an exhibition of motor cars by wireless power, suggested to an inventor a new application of the wireless principle. The instrument includes the installation of a wireless sending apparatus, with a radius of only a few hundred yards, and a small receiving instrument, such as are used now without the need of aerial wires. When the owner of the car leaves it unprotected for a time, he switches on the "wireless" and walks away. Any interference with the ignition system is at once "wirelessed" to the owner, who carries the receiving instrument in his pocket. The buzzing of his receiver sends him scurrying to his car.

A fine drill made from a needle

A Drill Made from a Needle

SMALL drills for watchmakers can be made from needles which are tempered, filed at one end to the usual shape of a drill point, and fitted at the other end with a small brass or copper handle.

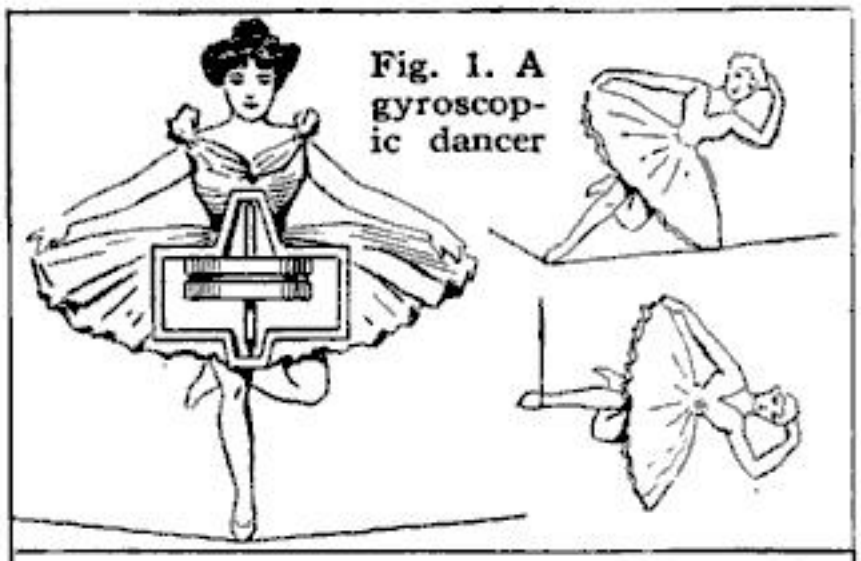


Fig. 1. A gyroscopic dancer

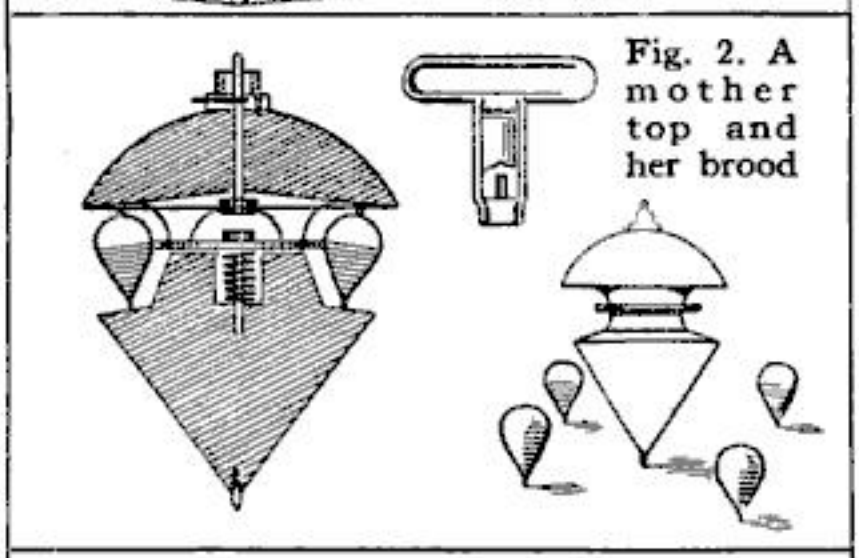


Fig. 2. A mother top and her brood

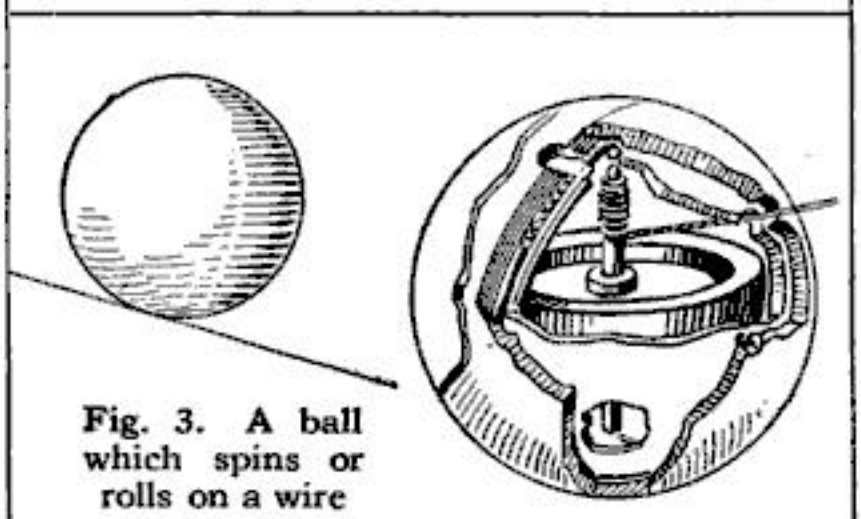


Fig. 3. A ball which spins or rolls on a wire

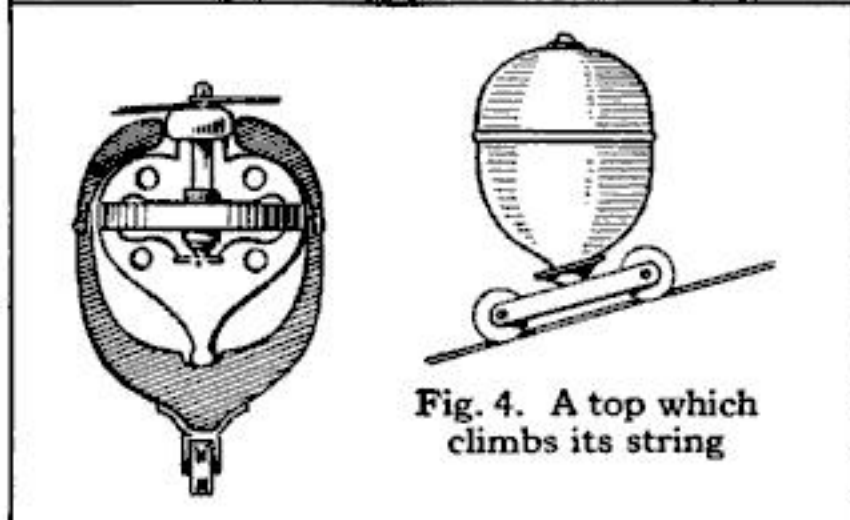


Fig. 4. A top which climbs its string

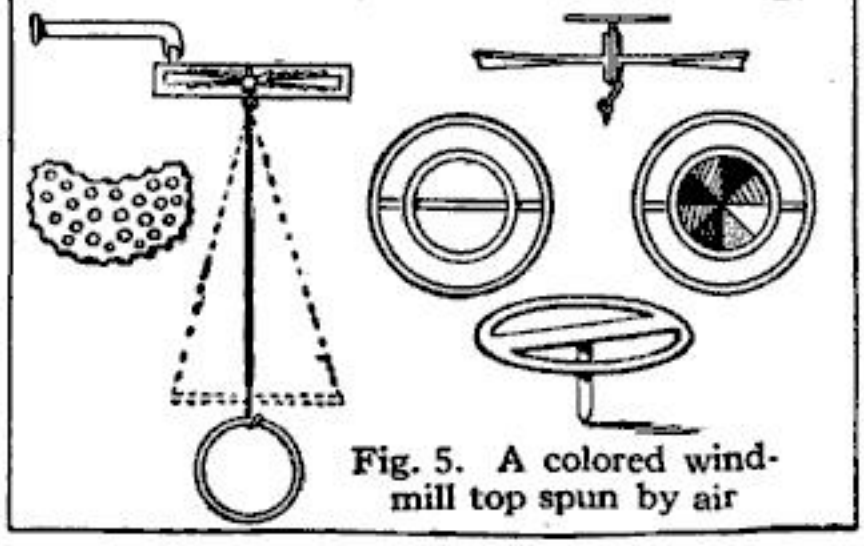


Fig. 5. A colored windmill top spun by air

Mechanical Tops

SPINNING-TOPS, like toy soldiers and other necessities of boyhood, have existed for many years. Recently, the old standby made from a spool with a peg pushed through the center, has succumbed to more scientific devices. The principle of the gyroscope is frequently used. The little ballet dancer, Fig. 1, can spin on her foot, her arm or her head, because of the gyroscope mechanism which is concealed inside it.

A toy which resembles an old hen and her brood of chickens, consists of one large top having several lateral cavities with small tops mounted in them, Fig. 2. When the big top is spun, a disk attached to its shaft rotates also, and the outside of this disk, touching each of the small tops, causes them to spin.

Jugglers and acrobats have a ball which will balance on a wire, resist all efforts to roll it, or roll in only one direction, Fig. 3. The gyroscope principle is involved in this toy.

Another top for balancing on a wire has an egg-shaped case with a removable cap, Fig. 4. The mechanism, enclosed within this case, spins in a tiny depression. The case is mounted on a miniature truck of two wheels.

The principle that a whirling body tends to rotate about its shortest axis is demonstrated in a toy consisting primarily of a blow-mill encased in a circular tin box, Fig. 5. Attached to the axis of the fan is a long cord terminating in a hook. When the fan is rotated, the cord becomes rapidly twisted. A ring suspended from the hook will rotate in a horizontal position.

Variations from the simple ring may be used, one being a ring having a concentric disk of primary colors. Rapid rotation tends to resolve the colors into white. The opposite phenomenon may be illustrated by means of irregular pieces of white cardboard with holes punched in them; they tend to break up white light into colors.

One of the newest ideas in toys is a real musical top, Fig. 6. A hollow cone has a vertical shaft projecting beyond the upper rim and having a central hole in which a nail may be inserted for

Which Puzzle

spinning. The cord is wound around the shaft, and after being quickly withdrawn, the nail should also be lifted out. The music is made by short tubes in the sides, placed at right angles to the diameter of the cone. Tiny reeds attached to their inner ends are vibrated when the top is spun.

A game in which tops are pitted against each other for speed, requires the use of a top having a depression in its upper surface for a fan, Fig. 7. The air-currents created by rotating the top revolve the fan. Numerals on the rim of the cavity indicate the movement of the fan.

For those who like to solve puzzles, the art of spinning a top must also be acquired if they wish to solve the puzzle-top, Fig. 8. A central, circular tube constitutes the body of the top. From it project radially four tubular arms. Four balls are free to move in these arms but they must pass through the central part. The trick is to spin the top with a ball in each arm.

The chameleon top, Fig. 9, has a semi-circular depression in its upper face in which are held, by means of a screen, several cubes having different colors on their surfaces. Rapid rotation of the top forces the cubes outward and diverse color combinations are presented.

A "flying" top, Fig. 10, has two propeller blades pivoted on its sides. When the top is not being spun, two coiled springs hold the blades inside the body, but the centrifugal force exerted in rotation forces them out through the lateral slots. The top literally rises from the table, the degree of upward movement depending upon the force expended in setting the toy in motion.

A very novel effect is obtained with a top having an auxiliary wheel, Fig. 11. The body is in the form of a globe very much flattened on the upper and lower sides. The auxiliary wheel is simply a disk painted with the primary colors, and having a central pin. When the top is in motion, the wheel is laid on the spinning-surface, its edge touching the top and its axis pointing inward toward the spinning-point. It will then rotate with the top, producing a peculiar, fascinating effect.

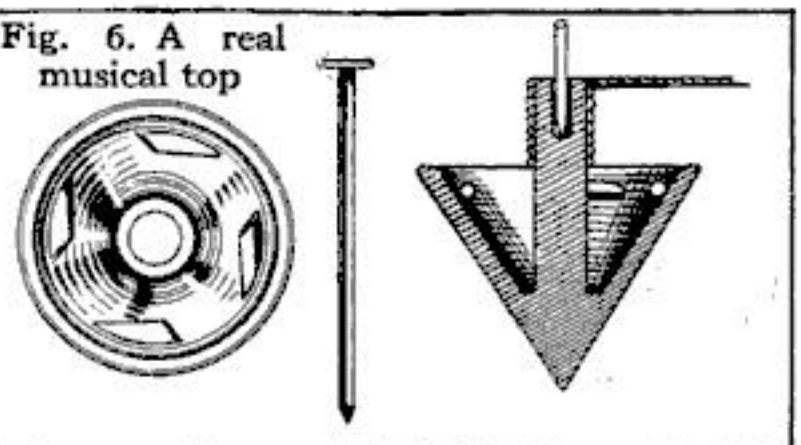


Fig. 6. A real musical top

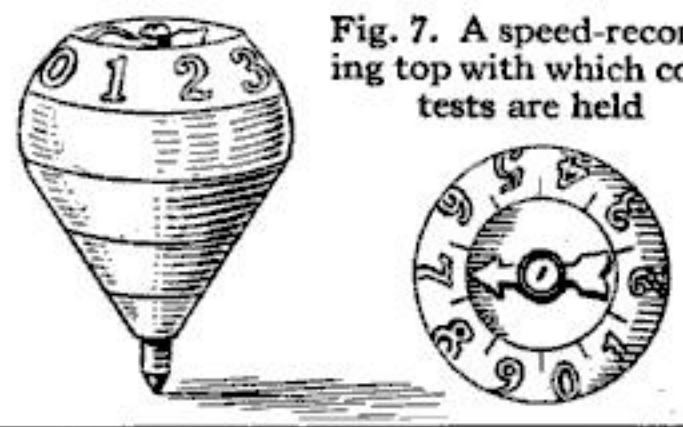


Fig. 7. A speed-recording top with which contests are held

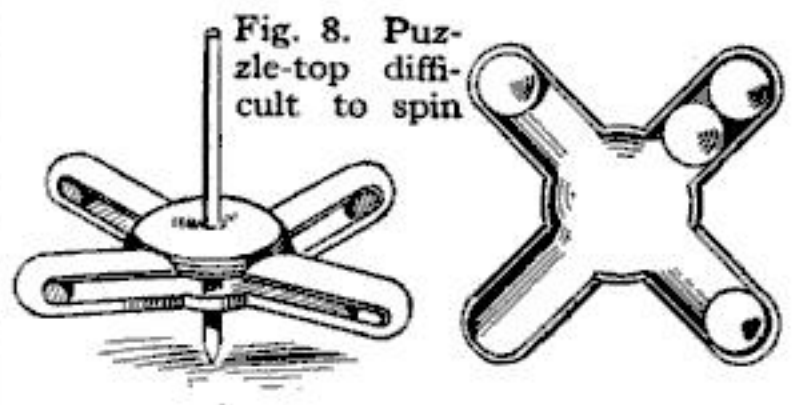


Fig. 8. Puzzle-top difficult to spin

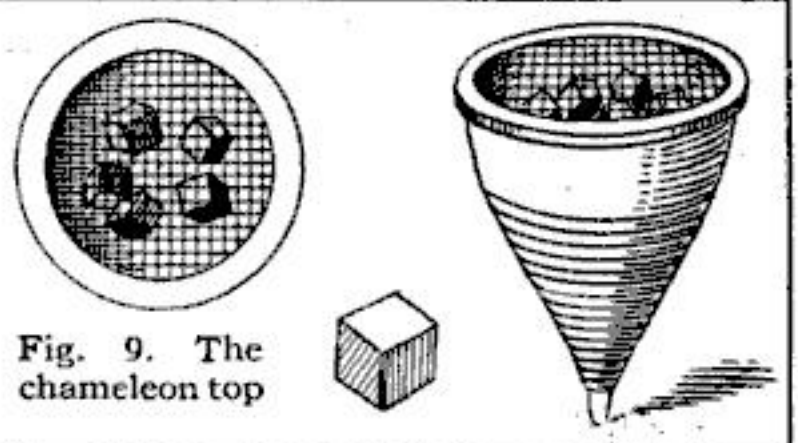


Fig. 9. The chameleon top

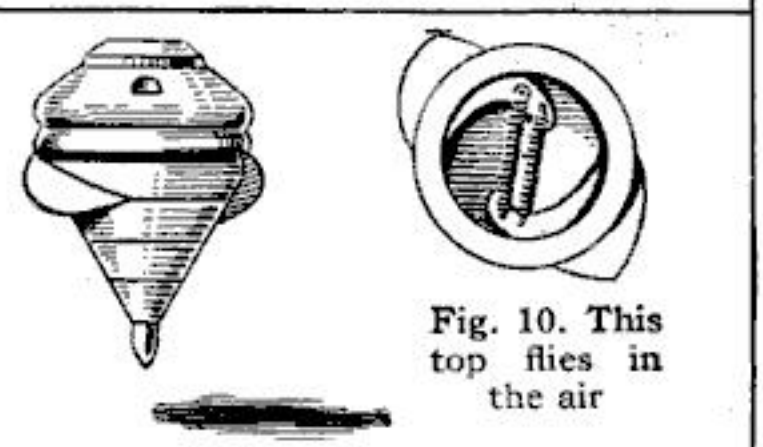


Fig. 10. This top flies in the air

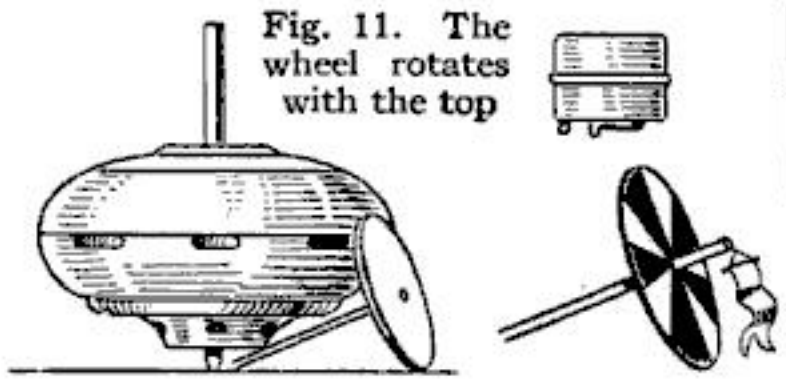
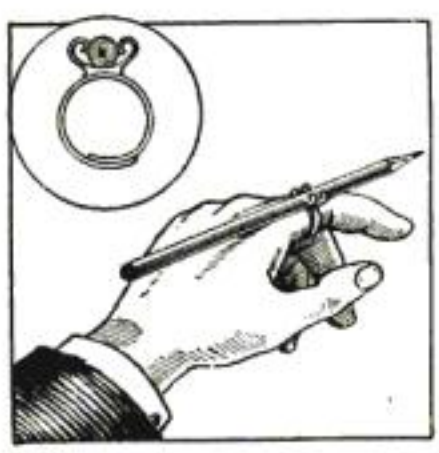


Fig. 11. The wheel rotates with the top

Little Inventions to Make Life Easy

Why Weren't They Thought of Before?

Finger-Ring to Be Used as a Pencil-Holder

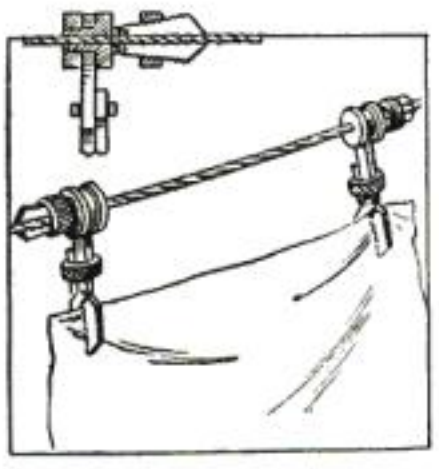


A V-SHAPED spring clip is attached to a finger-ring, and is used to hold a pencil in a convenient place so that the user will not have to search for a mislaid pencil constantly and yet leaves the hand free.

This Grease-Cup Keeps Your Hands Clean

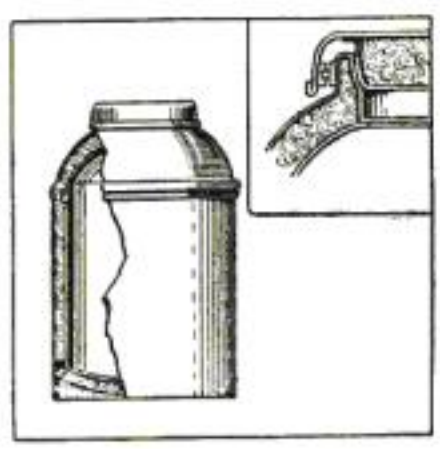
TO obviate the necessity of removing the grease cup when it is desired to fill it with grease, an inventor has inserted in the cup a washer which acts as a plunger to force out the grease. This washer runs on a screw-threaded stem, which is operated by a thumb-screw in the head of the cup.

A Clothes-Pin with a Sandow Grip



A clothes-pin has been patented with a grip sufficiently firm to resist the strongest wind. On the wire or rope used for drying the clothes, is attached a ring which projects downward, and terminates in two short arms similar to the blades of a pair of scissors, but having corrugated surfaces for gripping the clothes. Above the pivot the outer surfaces of the arms are also corrugated to engage a ring nut, which can be tightened when fastening the pin on the clothes.

Keeping the Heat Out of Milk-Cans

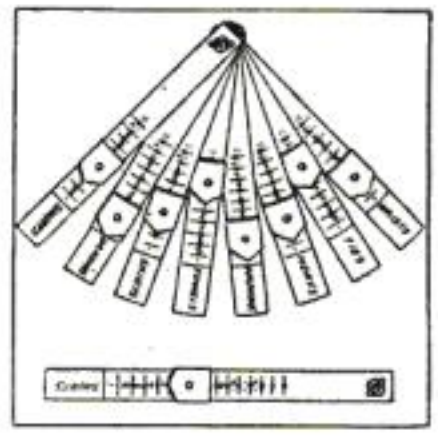


A MILK-CAN especially designed to keep out heat is the latest improvement in dairy appliances. It consists in reality of two cans, one within the other. The space between them is filled with felt, ground cork or other heat-insulating material.

An Electric Whirlpool to Suck Flies to Their Doom

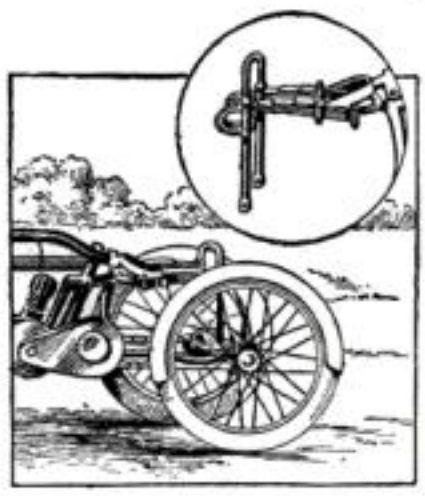
THE latest fly-killing engine is a small motor encased in a handle with a cord which attaches to an ordinary electric socket. The motor operates a miniature electric fan placed eccentrically in the open end of the handle. Air is sucked in and swirled around the circumference of the casing and forced out through a bent tube ending in a screened trap. Insects coming within reach of the "deadly wind" are sucked in and killed.

Counting Up on Steel Fingers



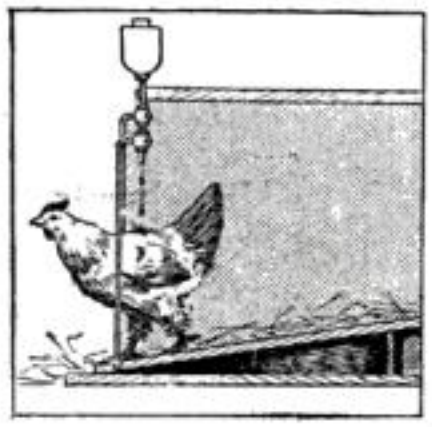
AN improvement on the old method of counting on one's fingers is a new device having several strips of steel pivoted at one end. At the "finger tips," are written the names of the various articles which are usually sent to the laundry, such as "shirts," "handkerchiefs," and "collars." On each "finger" is mounted a slide which may be quickly moved to register the number of pieces.

Converting a Motor-Cycle Into a Tricycle



A MOTOR-cycle may be easily transformed into a motor-tricycle, by the use of a patented axle which is attached by lugs to the lower end of the frame. On the upper end of the frame is bolted a spring, to which are attached two uprights for the axle. By this means the substitute axle is securely fixed to the motor-cycle frame. A belt-drive from the engine transmits the power to the two rear wheels.

Rough on the Hen—But Useful

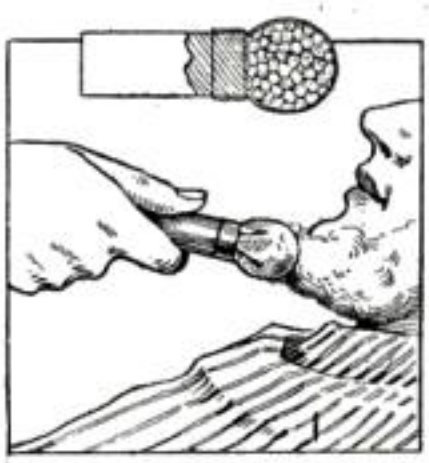


IN order that the poultry breeder may identify the hens which have a propensity to enter the nest to set needlessly, a valve containing ink or liquid dye is placed at the opening of the nest. When a hen enters the box containing the nest, a trap-floor drops, pulling a string which opens the valve, thus allowing some of the marking fluid to fall on the hen's back.

To Keep Your Foot Always on the Accelerator-Pedal

TO provide a safe and comfortable rest for an automobile driver's foot so that he may keep his foot in the proper position near the accelerator-pedal, a rest has been invented, which consists of a tubular piece of metal to be bolted to the floor at the desired spot. On one side of the rest is attached an upright piece of metal, which acts as a guide to prevent the foot from slipping in an emergency. The rest fits directly under the arch of the shoe.

A Single-Service Shaving Brush

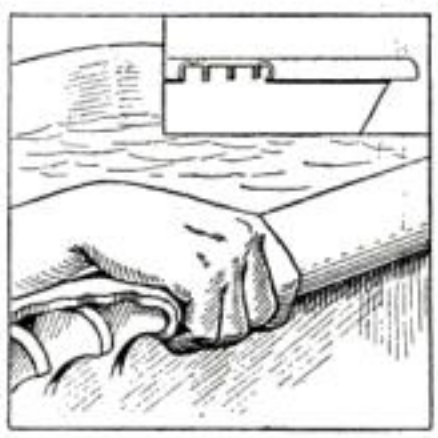


A SANITARY shaving brush which may be thrown away after having been used once is made of a pad of sponge or antiseptic cotton covered with a flexible material such as gauze or cheesecloth. This brush is impregnated with a sufficient quantity of powdered soap to lather the face. The brush is adapted to be made in large quantities at a very low cost, so that it may be thrown away after every shave.

Adjusting the Big Shoe-Stand to the Little Boy

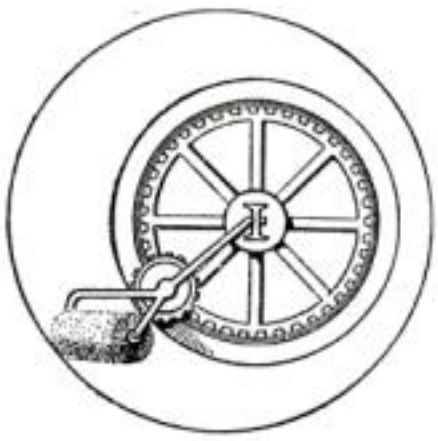
TO enable small children to have their shoes polished without difficulty, an inventor has made a pair of substitute foot rests for a polishing stand. These rests may be easily attached to the stand, and are so designed that they will accommodate any size of chiid's shoe. A pair of heel and toe clamps are attached to the shoe plate and are connected by means of a coiled spring.

Finger-Holds for Your Slippery Bath-Tub



SOME difficulty is often experienced, especially by invalids, aged people and children, in seating themselves in the modern enamel or porcelain bath tubs. The surfaces are naturally slippery, and this difficulty is increased by the presence of water and soap. An inventor who must have slipped has provided gripping surfaces under the rolled edges of the tub, so that the bather may easily change his position.

Brushing Away the Tacks

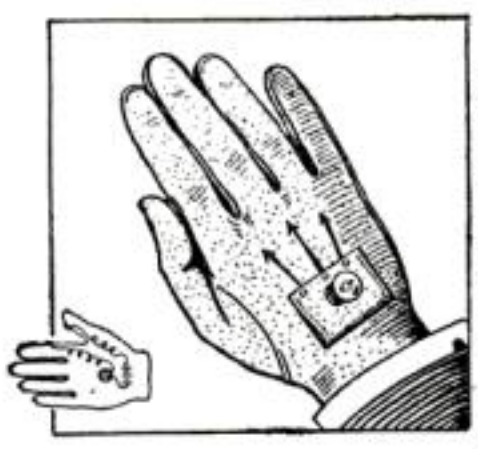


A REVOLVING brush has been devised for sweeping aside small objects likely to puncture an automobile tire. Attached to the axle is a framework, holding the brush and two gear-wheels. The small gear-wheel engages with cogs on the rim of the automobile wheel; and the large gear-wheel operates the brush, thus rotating the brush in an opposite direction to that of the moving tire.

This Toothbrush Can Be Used Only Once

THE bristles of this novel toothbrush are made of some material which becomes soluble upon application of water. After having been used once, the toothbrush is useless, and a new one must be provided. A suggested composition of the bristles is a mixture of antiseptic formaldehyde tooth powder, paper pulp and an adhesive of an antiseptic or sanitary nature.

A Lamp for the Motorist's Glove

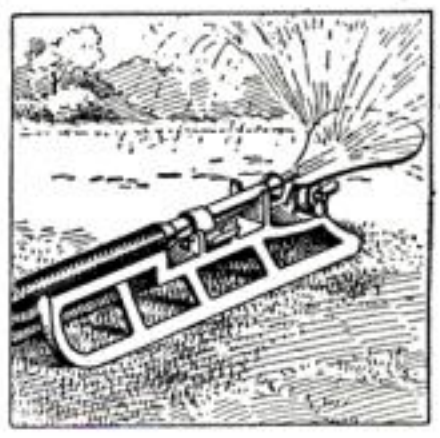


EXTENDING the arm to one side as a warning to drivers behind is well-enough in the daytime. At night some other expedient is necessary. To overcome this difficulty a new device has been patented consisting of a glove with a small electric light fitted into the back near the wrist. The contact points are on the index finger and the thumb so they can easily be brought together. The wires pass through the glove between the inner and outer layers.

Keeping the Cow's Tail Out of the Milk Pail

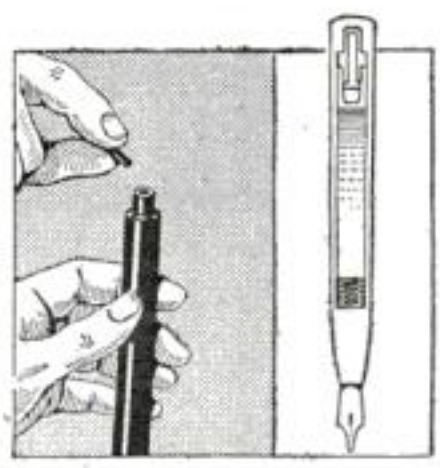
TO prevent a cow from switching her tail while being milked, a large, heavy clip is made of some metal, preferably iron or steel. On the inside of each block of metal, forming the faces of the clip, is a groove which receives the tail comfortably. A suitable spring holds the two faces of the clip tightly together. With the heavy clip on the end of her tail, the cow is unable to switch it freely.

A Sled for Lawn-Sprinklers



AN arrangement for holding the nozzle of a hose used in spraying consists of a sled-like framework with two upright pieces having grooves for the reception of the nozzle. Over one groove or notch is a clamp for securely fastening the hose. Just in front of the mouth of the nozzle is pivoted a spoon-like spreader or deflector. A thumb-screw makes it possible to adjust this part at any desired angle.

Does This Solve the Refilling Problem for Fountain Pens?



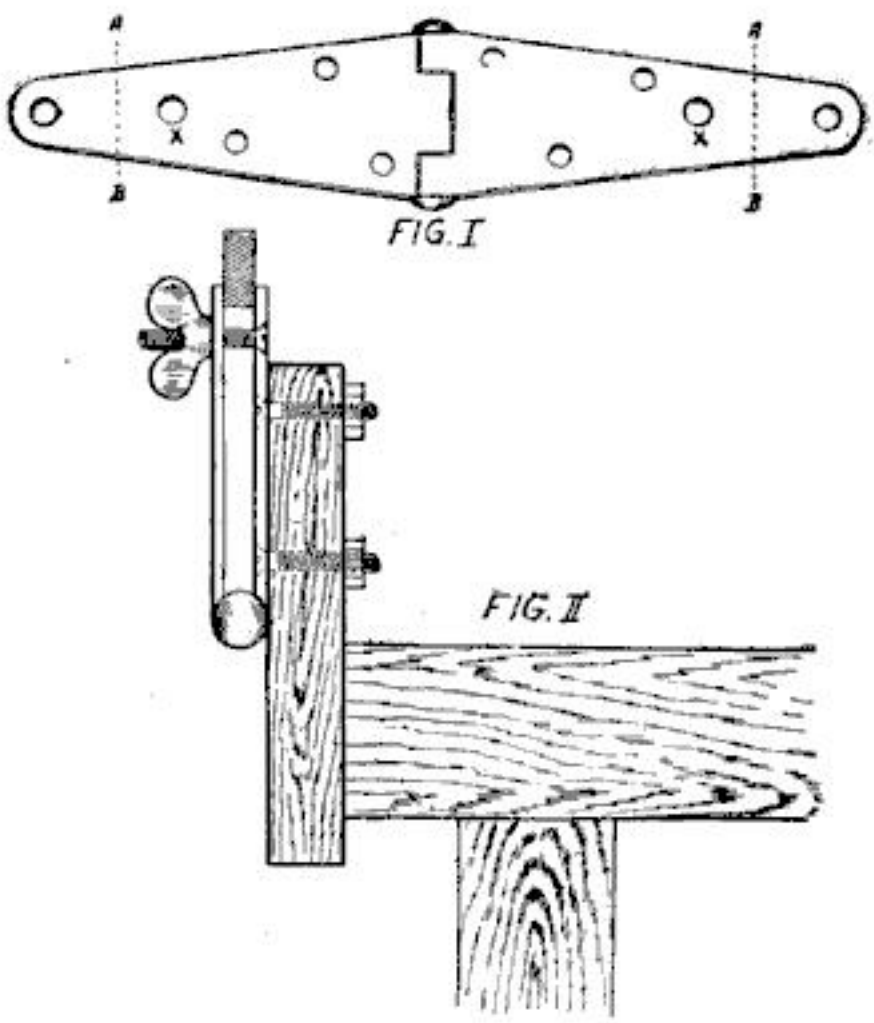
IN order that a solid ink may be used in a fountain-pen, and in order that the ink may be renewed without soiling the fingers, a small receptacle is made to screw into the upper end of the barrel. When the cap protecting this upper end is removed, a pellet or stick of solid ink is dropped into the receptacle, and the other end of the barrel is filled with water.

For Practical Workers

Using a Hinge for a Vise

A SERVICEABLE and durable vise may be made with a few simple tools, at a very small cost. Procure an 8 or 10-in. strap hinge and cut it off along the lines marked *A-B* in Fig. *I*. Fasten the hinge, with two small bolts to your workbench or on to a board, which may in turn be fastened to the bench, as in Fig. *II*. Secure another bolt of ¼-in. diameter, 2½ ins. long, and thread it for a distance of 2¼ ins. Insert it through the holes *X*, *X*, which should be drilled before the hinge is fastened to the bench. See Fig. *I*. Put on a winged nut and your vise is complete.

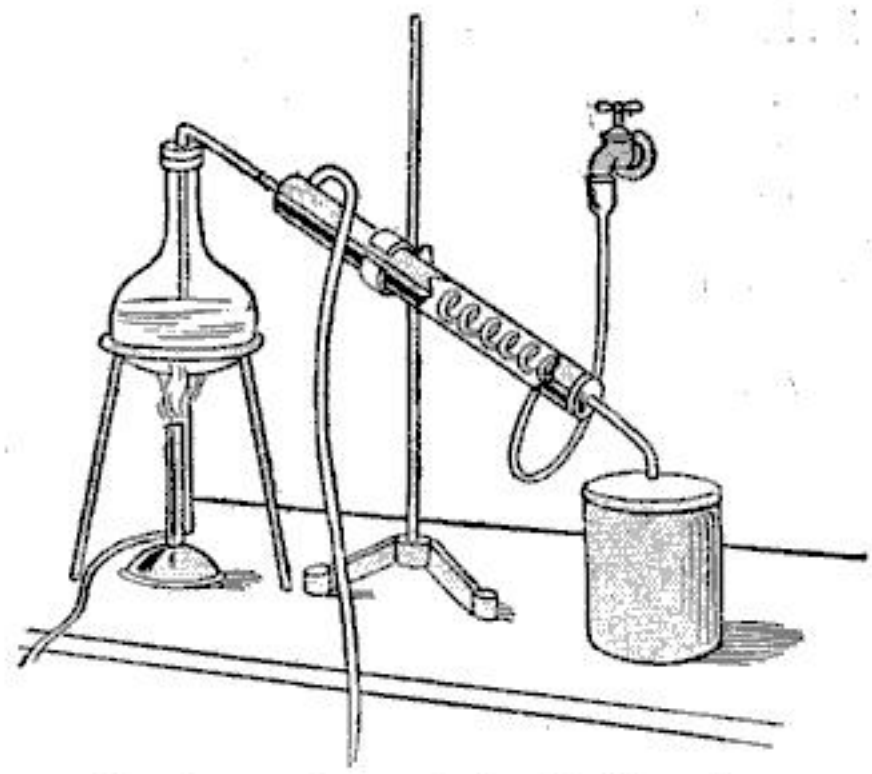
Any hinge may be made to serve as a clamp in the same way, by putting a small bolt through two of the holes and tightening up the winged nut with a wrench.—H. W. LUEDDECKE.



A strong hinge makes a good vise if adjusted in this fashion

How to Make a Distilling Apparatus

EVERY chemical laboratory requires a good, distilling apparatus for obtaining pure chemicals. The one here described is inexpensive and easily made. A piece of brass or copper tubing 20 ins. long, with a diameter of 2 ins. and a thickness of about 1/16 in., is fitted with 2 rubber stoppers 1⅞ ins. in diameter, having a center hole of ¼ in. Two holes 5/16 in. in diameter, are drilled 2 ins. from each end, and 2 brass tubes 1½ ins. by 5/16 in. are carefully soldered into them. One of these tubes is for supplying water to the large tube, which acts as a water-jacket, and the other is for discharging the water.

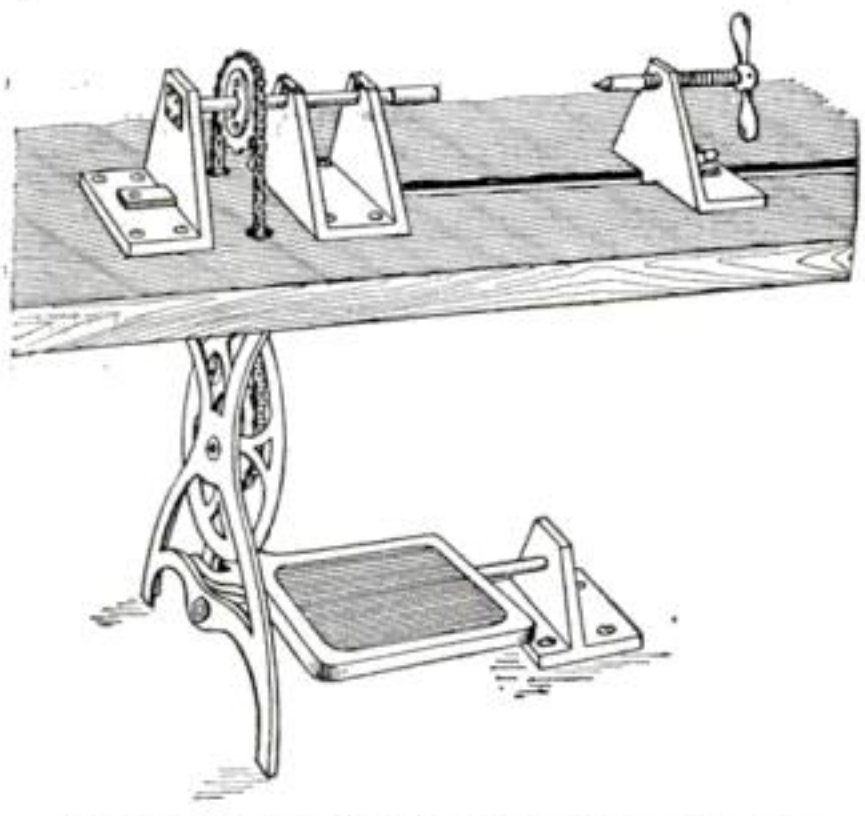


Running water and simple laboratory equipment serve to make this still

The inner tube is made of glass stock ¼ in. in diameter and 40 ins. long. By means of a Bunsen burner with a wing tip, the glass tubing can be bent into the shape indicated in the illustration, having 10 curves, each 1¼ ins. long. Heat the tubing until it is cherry-red and then carefully bend it into the proper shape, but wait till it is cool before making the next curve. Care should be taken to have the curves uniform for fitting into the metal tube. One end is now fitted into a rubber stopper, which supports it in the water-jacket. The other end should be smeared with vaseline and inserted in the other stopper, and that in turn in the outer tube. Each of the short side tubes should be fitted with a length of rubber tubing, one being attached to the water-faucet and the other to the drainage pipe. Chemicals of all kinds, including mercury, may be purified by means of this apparatus.—SAMUEL COHEN.

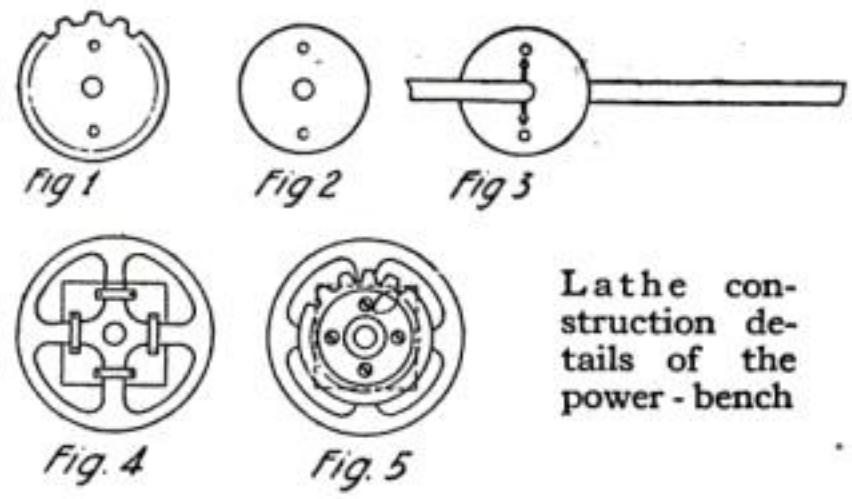
Making a Handy Power-Bench

EVERY workshop should include a power-machine like the one shown in the illustration. It can be used as a wood-turning lathe, for running an emery-wheel, and, in fact, for many other



This arrangement of a power-bench can be made on an old sewing-machine body

necessary operations. Procure a chain and two bicycle sprocket wheels, a steel rod, ranging from ¼ in. to ½ in. in diameter and 1 ft. long, one side of a sewing-machine stand, with the wheel and



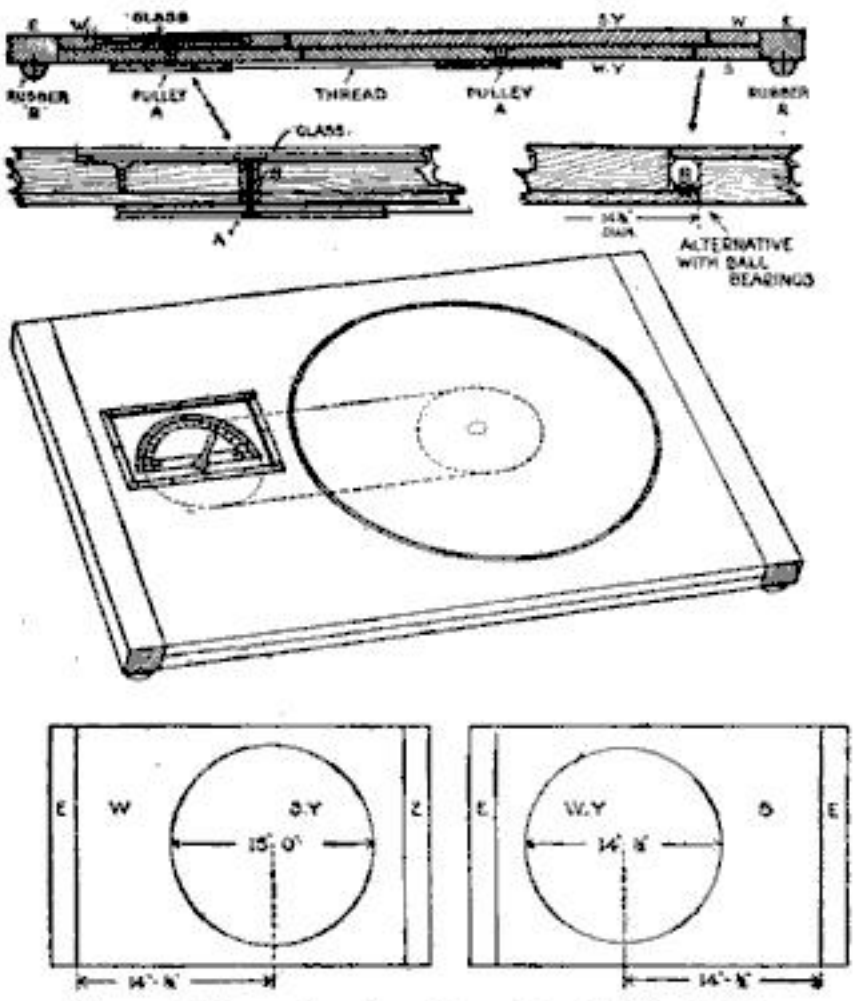
Lathe construction details of the power-bench

treadle, a piece of galvanized sheet iron, 1 ft. sq., but not too thick, a thumb-bolt, and a clamp from an old emery-wheel.

Screw four supports to the top of the bench, as shown in the illustration. The one to the extreme left has a hole drilled near the top and a short piece of tubing fitted into it to receive the shaft. Screw a piece of iron on the back to act as a stop for the shaft. Make grooves in the tops of the two middle supports and, after inserting tubing, screw galvanized strips over the tops to secure the shaft. Drill a hole in the support represented at the right. Make it a size smaller than the thumb-bolt, which should be filed to a point, and insert the bolt. In placing these supports and drilling the holes, care must be taken to keep the shaft perfectly level and in a straight line with the thumb-bolt.

Make a slit in the bench exactly parallel with the line of the shaft. Drill a hole in the base of the right support and insert a bolt to pass down through the slit. Make two holes in the bench at the proper place to let the chains run through, and drill a hole in the shaft directly above. Place the part shown in Fig. 1 on that shown in Fig. 2, and both on the part shown in Fig. 3. Bolt them together, place them on the shaft, pass a nail or wire through the shaft, and solder it to them. At the end of the shaft a number of different forms of chucks may be used.

Fasten a small board to the sewing-machine wheel by means of strips as shown in Fig. 4. Then attach the gear, Fig. 5. A stick connecting the treadle with the wheel and a support for the treadle must also be adjusted before the machine is complete. When finished, anyone may be proud of this little power-machine.—HARRY B. DURLIN.



A revolving drawing-board of this design can be made by an amateur

Construction of a Revolving Drawing-Board

A DRAWING-BOARD that revolves will be of interest to many amateur draftsmen. The following dimensions may be altered according to the materials that the builder has on hand. Procure a board, ½ in. by 18 ins. by 24 ins., of any soft wood. By measuring down from the top of the board 9 ins. and in from the side 16½ ins., establish a point and describe a circle of 15 ins. diameter.

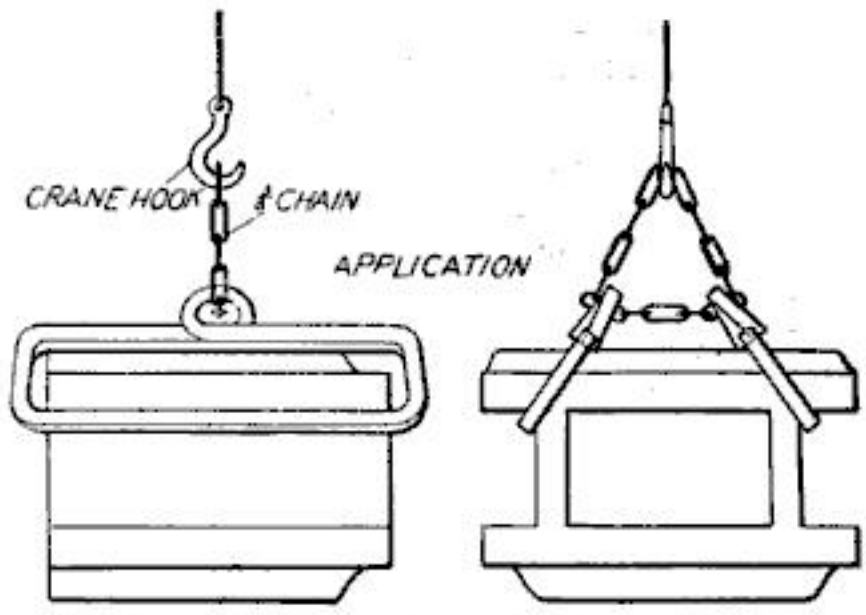
Prepare another board of the same dimensions, with a circle of 14½ ins. diameter. By means of a band saw, remove the disk within the circle of each board. Glue the two boards, *W* and *S* together, the centers of the two circles coinciding. The two disks, *SY* and *WY*, should be similarly glued together. Glue two rectangular strips of hardwood *E*, 1 in. by 2 ins. by 18 ins., on the ends of the rectangular boards to prevent warping.

Make two pulleys *A*, 4 ins. in diameter, with a V-shaped edge. Attach one pulley to the bottom of the circular board. Measure from the left side of the rectangular board 5¾ ins. in on the center line and drill a ¼-inch hole. Into this hole, force a piece of brass tubing, ¾ in. long, and having an inside diameter of ⅛ in. In the top board, make a rectangular opening, 6¼ ins. by 3⅝ ins. by ¼ in., so that the small hole just made will be at the middle of the lower long side, as shown in the diagram. At this point, fasten a protractor.

A short piece of steel rod, ⅛ in. in diameter, must be threaded at one end. Attach a needle or pointer, such as a clock-hand, to the other end and place the rod in the brass tubing. Fasten the other pulley to the under, threaded end by means of nuts. Pass a thread around the two pulleys and tie it securely. Rubber tacks should be driven into the bottom of the board at the four corners. The dial may be kept clean by means of a piece of glass, 6¼ ins. by 3⅝ ins. By adjusting the index finger, the revolving board, with its drawing, can be set at any angle which may be desired.—H. ALEXANDERSON.

The Construction and Use of a Safe Driving-Box Lifter

THE device illustrated is for lifting driving-boxes with a traveling crane, for use with planers, boring-mills, drill-presses and the like. It is made from two forgings and a ⅜-in. chain. The two rectangular links are made from ¾-in. iron. The ring is made first, then the rectangle, and lastly the two are welded. They slip over the driving-box as shown. As soon as the crane-hook is hoisted, the two links are drawn together. An accident is practically impossible. The size of the link can be made to fit any driving-box, though it can be used for any box it will go over. The only exception is when the box is too small.—JOSEPH K. LONG.



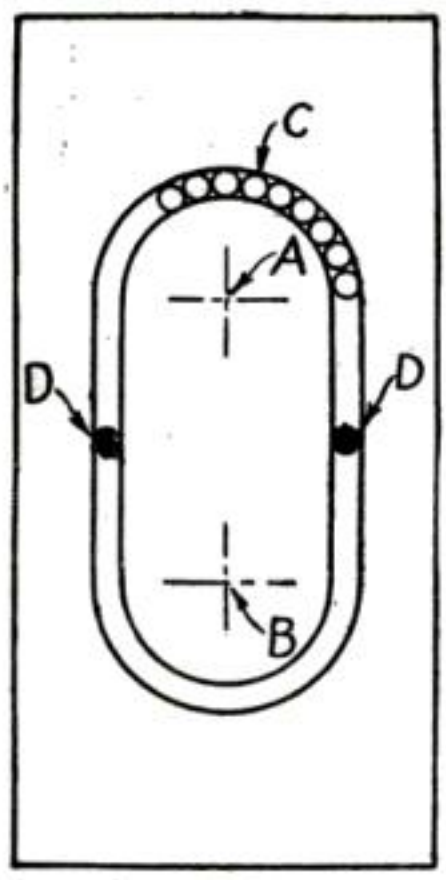
Lifting the driving-box of a locomotive is simplified by this device

A Pipette Attached to a Bottle

A SMALL pipette may be suspended from the cork stopper of a bottle, by means of an ordinary eye-bolt whose diameter is slightly larger than the diameter of the dropper. The arrangement is clearly depicted in the illustration.

If the bottle is shorter than the pipette, a rubber band may be attached to the pipette, forming a flange to engage the ring of the eye-bolt. This device is especially useful in hospitals and homes, where sanitary measures should be observed.—P. F. QUINN.

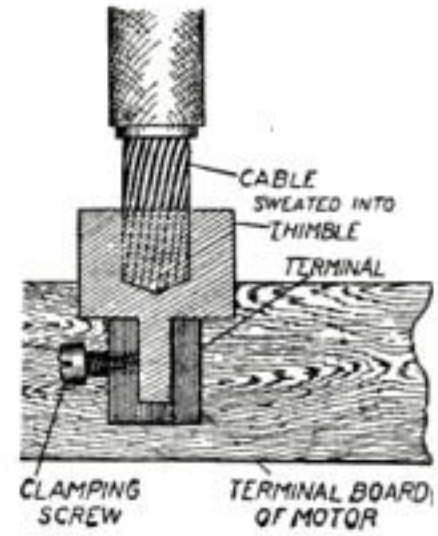
Making Dies of Difficult Outline



IN making a die for punching out plates of an unusual outline, such as the one shown in the diagram, the following method may be employed to advantage:

Lay out the figure carefully, drill the holes *C* and knock out the plug. Replace the plug and secure it by means of two pins, *D*, *D*. Bolt the plug to the face-plate, parallels being placed between the face-plate and die so that the plug can be driven towards the face-plate and dropped out. Locate the point *A* which is the center of a circle whose circumference coincides with the outline of the end of the figure. The plug should now be removed and the half-circle bored out and clearance given to it. Next, remove the die from the face-plate and replace the plug with the pins. Fasten the plug to the face-plate, locate the point *B* and bore out the semicircle, as before. Finish the two flat sides between the semicircles with an end mill in a milling machine.

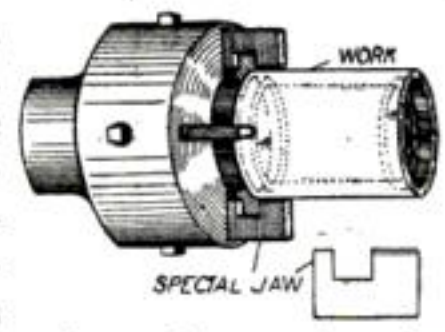
How to Fit Cables Into Small Terminal Holes



IN installing an A. C. induction motor, it sometimes happens that the holes in the terminals on the terminal board are too small to receive the ends of the cable. Instead of the common but unsatisfactory method of cutting strands of wire off the cable to make a fit, the following method is suggested:

Make some brass thimbles and sweat them on the cable ends, as shown. The thimbles are made from a round brass rod large enough for boring a hole to fit the end of the cable. The other end is turned down to fit the hole in the terminal block.—H. HUNTER.

A Set of Jaws for Counter-Boring and Facing



THE diagram shows a special set of jaws made for use on the lathe-chuck when counterboring and facing the inner ends of castings, such as that shown in the illustration. The jaws being cut away allows plenty of room for facing the ends. The cutter used is a lathe-tool set in the tool-post.—C. ANDERSON.

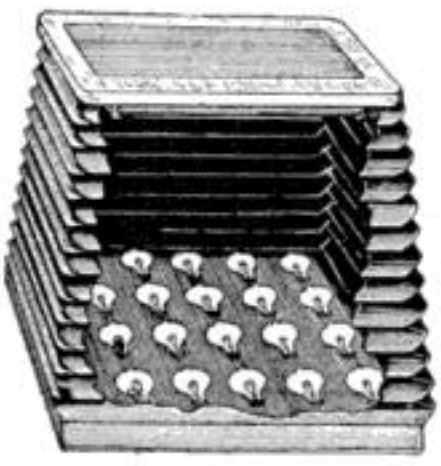
No Corkscrew Needed

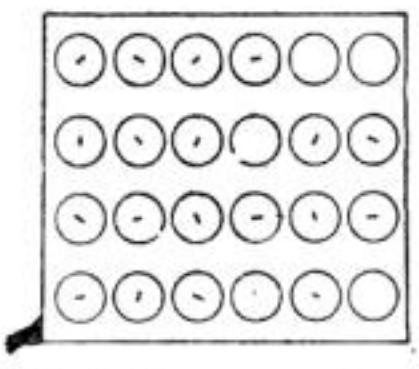
IF manufacturers would loop a piece of strong cord, the length depending upon the size of the stopper, around the cork before inserting it in the neck of the bottle, they would greatly help their patrons. This would do away with corkscrews and would save time.—WM. ED. FINKERNAGEL.

How to Keep the Baby in His High-Chair

TO prevent a baby from standing up in his high-chair, try this: Remove the leather handle from an old razor strop. Cut a slit in the center from end to end, leaving about an inch at each end uncut. Fasten one end of the strop to the inside of the back of the chair, with 2 screws, 3/8 in. in diameter. Hook the other end up under the feeding shelf. The slotted belt rests comfortably on the baby's shoulders and he is perfectly safe.—BERNARD SPIVAK.

A Substitute for a Condenser when Making Enlargements

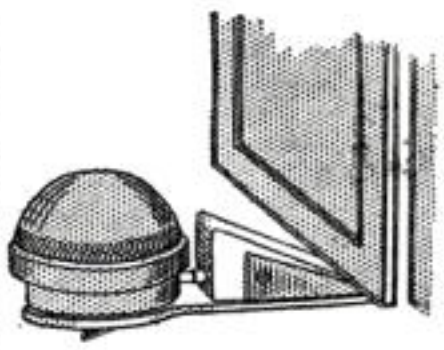




FOR enlarging photographs under artificial light by the projection process a good condenser, of diameter sufficient to cover the negative used, is necessary to insure even distribution of light on the print. The object of the condenser is, of course, to distribute the light more evenly to each and every corner of the negative. A good substitute for a condenser—lenses suitable for large negatives are expensive—is a lamp-board mounting a number of miniature tungsten bulbs so that the light is distributed fairly evenly over the whole surface of the negative, instead of being concentrated at a single spot, which is the case when a single lamp is used without a condenser. The board should be slightly larger than the negative to be enlarged, and should mount as many lamps as it is possible to squeeze into the surface. If 6-volt lamps are used, 18 or 19 can be connected in series, to be used on the house-lighting circuit.

The lamp-board should be mounted well away from the negative at the free end of a bellows, so that the board can be kept in constant movement while the print is being made. This helps to distribute the light more perfectly. Excellent results can be obtained with this simple apparatus.—E. F. HALLOCK.

A Wedge as a Burglar-Alarm



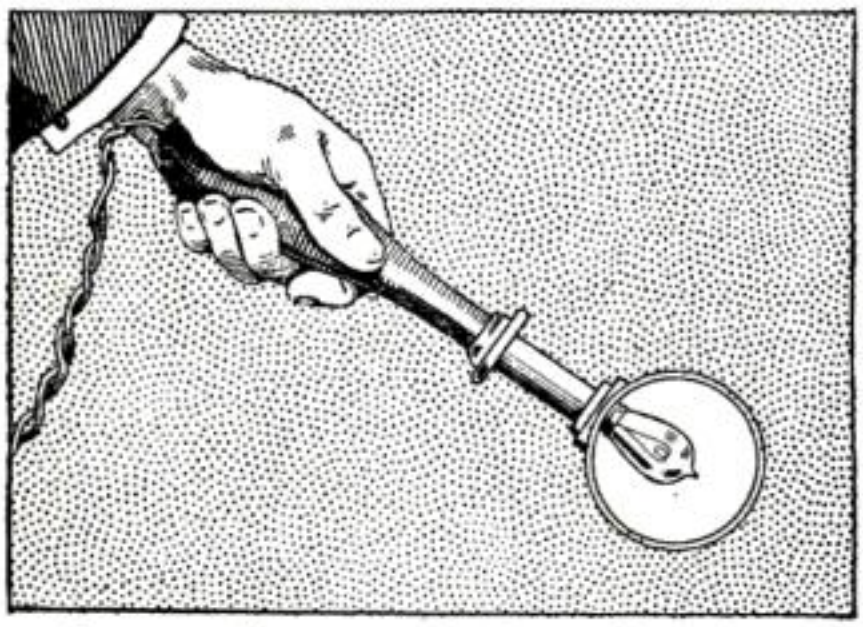
AN excellent burglar alarm for the home or for use when traveling is seen in the illustration. It consists of a wedge, which is placed in the interior of the bedroom under the door. It carries several small points or claws on the under side, which grip on to the floor, making it impossible to open the door even by the hardest pressure. Besides, a bell rings when the device is pushed upon, for the wedge part slides back slightly upon the base, actuating a rod which sets off the bell mechanism. For use in hotels when traveling, the little device is one of the most practical, and, being small, it can be stowed in any baggage. No key is needed to wind up the bell. The bell itself is turned about by means of its milled edge as will be seen in the illustration.—F. P. MANN.

An Easy Way to Remove a Broken Chair-Leg

IT IS sometimes difficult when repairing chairs and other household furniture to remove a broken end from the base, except by boring. If a screw-nail is driven into the broken end and then a claw-hammer applied, the broken end may be removed very easily.—JEFFERSON RUSSELL.

An Improved Darkroom Lamp

A METHOD of darkroom illumination is shown in the accompanying illustration. The negative may be examined thoroughly during the process of development without unduly exposing the plate. A two-candle-power incandescent lamp is attached to a handle and enclosed by a hemispherical reflector, closed at the front with a disk



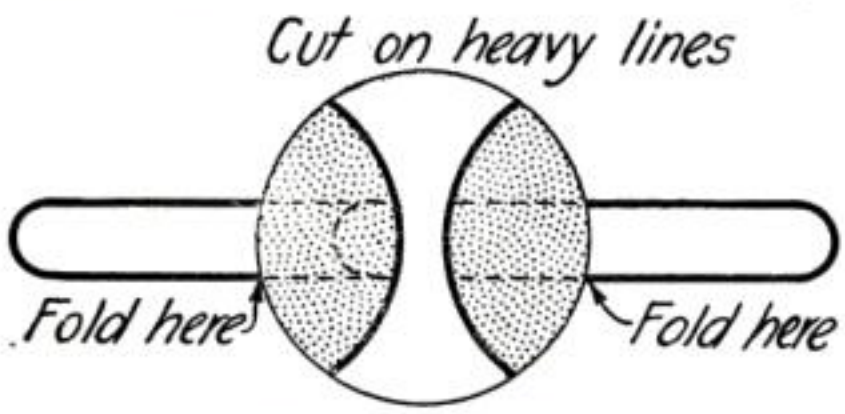
A two candle-power ruby lamp allows close examination of negatives during the process of development

of dark ruby glass. The lamp is held near the plate and all the light is thrown downward so that the eyes receive only the light reflected from the plate.

Only a small section of the plate is exposed to the light at any time. When the lamp is not being used for this purpose, it may be laid face down on the table or suspended so as to light the darkroom.—GEORGE YASTE.

How to Send Coins by Mail

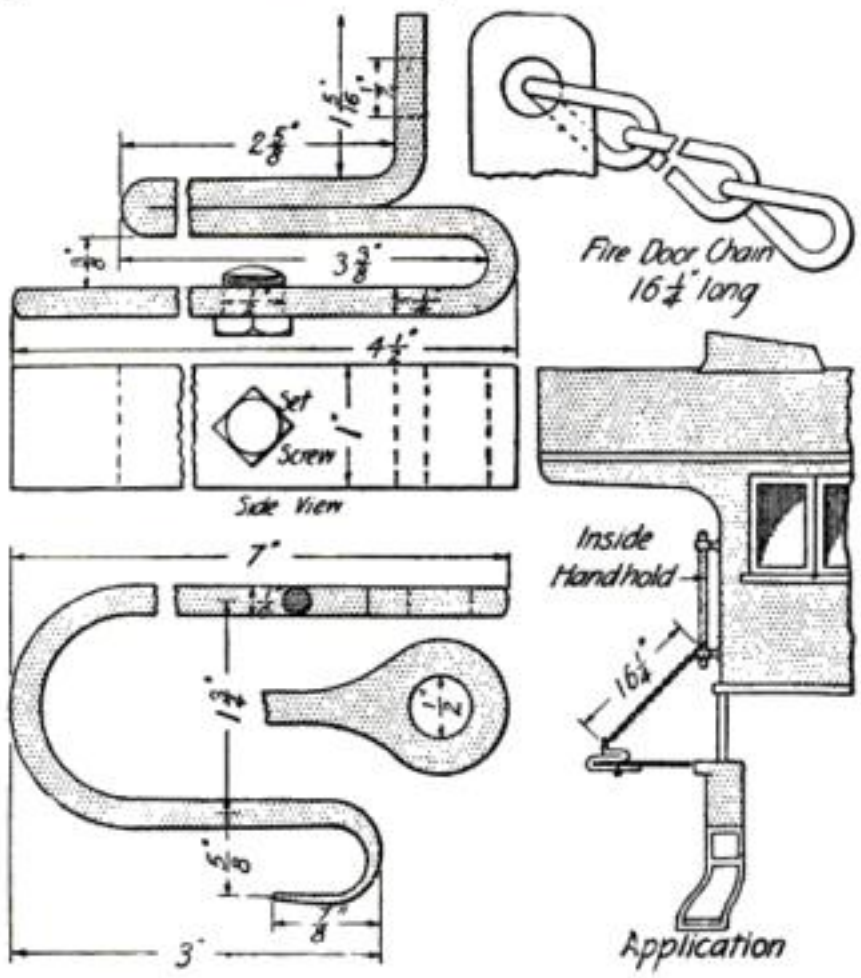
LAY the coin on a sheet of paper and describe a circle around it. Then with a knife, cut through the paper along the heavy lines, as indicated in the diagram. The coin may then be slipped underneath the central slip and the two flaps may be folded over the top.



A piece of stiff paper cut as indicated will hold a coin securely for mailing

A Locomotive Apron Lifter

THE device shown in the illustration is for holding up the apron between an engine and its tender, while coupling or uncoupling the tender. The apron is generally hinged to the cab brackets and is a mean thing to handle. This appliance is simply a small clamp which slips in over the edge of the apron and has a small chain with a hook on the other end which is fastened on hooks around the cab handhold. The details are clearly shown in the diagram. Note the small set-screw, which is tightened after the device is put on the apron, to prevent accidents.—J. K. LONG.



The "apron" between locomotive and tender will be held up safely with this device during coupling

Uncoupling Pipes

THE threads on steam, water, and gas-pipes are usually coated with white lead or paint when the pipes are coupled together; old pipes that have been put together in this manner are usually hard to uncouple. If the juncture is heated, the paint or lead will soften and the pipes can be taken apart very readily.

When two pipes rust together, pour a little oil on the exposed threads and allow the oil to soak in for a few minutes. Then heat to make the oil penetrate. The pipes may then be taken apart easily.—F. M. DEFENDORF.

How to Build and Sail a Small Boat

By Stillman Taylor

THE average boy will find it comparatively easy to build a thoroughly satisfactory sailboat, and no difficulty will be experienced if the simple instructions which follow are well understood before undertaking the work. A boat of this flat-bottom or "sharpie" model, is the easiest of all sailing craft to construct, it will be found safe and stable and will show a fair amount of speed with a reasonable spread of sail. It is, moreover, essentially a boy's boat, suitable for use on rivers and lakes, and because of the flat bottom, it draws but little water, and is upon this account a very desirable boat for use at the seashore, for it may be pulled up on the sandy beach.

The cost of building will naturally vary somewhat—depending upon the locality and the kind of fittings used. The finished hull may be built for $10, and if the mast is rounded out by the builder, and the sail is stitched by mother or sister on the sewing-machine, the total cost may be kept within $20. A completely rigged boat of this type will cost not less than $75 if made by a boat-builder.

In beginning the work, first cut out the stem as shown in Fig. 3. Oak or ash is the best material for this part of the craft, but cypress may be used. As may be noted in the diagram, the stem is rabbeted out on a bevel to receive the sideboards.

The sideboards may next be marked to the shape and dimensions shown in Fig. 2, and then carefully sawed out with a rip saw.

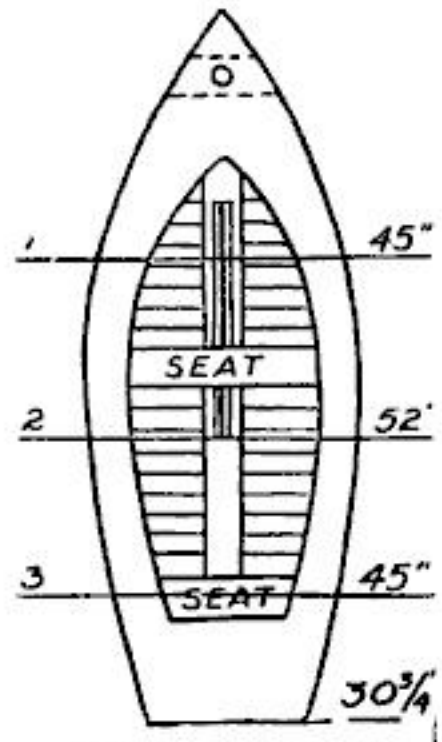


Fig. 1. Deck plan

The molds, which give the correct width and shape of the boat, are merely used to keep the sides in shape while putting in the ribs and flooring. These are removed when this part of the work has been completed, hence they may be made from any odd pieces of old lumber found about the house—packing boxes, etc. Three molds are required, the dimensions being shown in Fig. 4.

The stern or transom is best made of oak or ash, but cypress or cedar will answer very well. This is first drawn to shape and sawed out to the shape and dimensions shown in Fig. 5.

Having gotten out these pieces, the

Material Required for Hull

2 pcs.	Cypress	¾ in. x 18 in. x 15 ft	Sideboards
2 pcs.	Cypress	⅞ in. x 2 in. x 15 ft	Floor-stringers
2 pcs.	Cypress	⅞ in. x ⅞ in. x 14 ft	Seat-risings
1 pc.	Cypress	1⅛ in. x 9 in. x 12 ft	Seats
1 pc.	Cypress	⅞ in. x 15 in. x 8 ft	Sides centerboard trunk
1 pc.	Cypress	⅞ in. x 3 in. x 12 ft	Deck beams and knees
1 pc.	Cypress	⅞ in. x 2 in. x 30 in	Centerboard posts
4 pcs.	Cypress	⅞ in. x 3 in. x 18 ft	Decks
1 pc.	Oak or Ash	6 in. x 6 in. x 18 in	Mast blocks
2 pcs.	Oak or Ash	⅞ in. x ⅞ in. x 15 ft	Ribs
1 pc.	Oak or Ash	⅞ in. x 13 in. x 31 in	Stern transom
1 pc.	Oak or Ash	¼ in. x 5 in. x 12 ft	Cockpit coaming
1 pc.	Oak or Ash	¼ in. x 3½ in. x 46 in	Top centerboard trunk
2 pcs.	Oak or Ash	2 in. Half-Round Molding	Fenderwales
2 pcs.	Oak or Ash	½ in. Quarter-Round Molding	To cover tacked edge on coaming
1 pc.	Georgia pine	⅞ in. x 6 in. x 15 ft	Outside keel or shoe
1 pc.	Georgia pine	1 in. x 7 in. x 7 ft	Centerboard
1 pc.	Georgia pine	⅞ in. x 8 in. x 4 ft	Rudder
5 pcs.	Cedar or white pine	⅞ in. x 6 in. x 16 ft	Flooring-boards
5 yds.	No. 8 or 10 ounce Canvas		Deck covering

work of setting up the hull may begin. First nail the sideboards to the beveled scarf or rabbet in the stem, by a double row of nails. Galvanized cut boat-nails should be used, and a hole must first be bored before the nail is driven home. This must likewise be done in

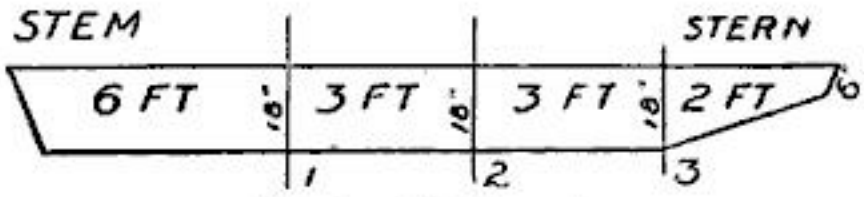


Fig. 2. Sideboards

fastening all parts together—otherwise splitting is likely to spoil the work.

Now place mold *A*, 5 feet from the stem (see deck plan Fig. 1), and after bending the sideboards around it, secure firmly in position, by tacking a batten across the sideboards at top and bottom. In doing this, merely drive the nails partly in, so that they may be easily removed later on. Place mold *B*, 3 ft. from mold *A*, fasten and set up mold *C* in the indicated position. Owing to the somewhat abrupt bend of the sides at this point on to the stern, a rope strap may be twisted around the sideboards like a tourniquet, to force the sideboards tightly up against and at right angles with the molds. Clamps may, of course, be used, if at hand.

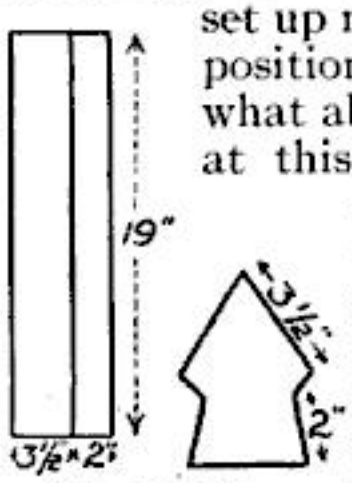


Fig. 3. Stem

The transom is now placed between the sideboards—outside flush with edges of sideboards—and fastened in place by nailing the sides to it.

The floor-stringers are now to be nailed along the inside bottom edge of each sideboard. To make the stringers follow the bend near the stern, make several slight saw-cuts across, so that the stringer may be sprung to follow the curve of the sides.

We are now ready to put in the oak ribs, and these must be nailed solidly to the sideboards. Space the ribs about 18 ins. apart, and nail with galvanized boat-nails, through the sideboards. Clench the ends on the inside of the rib.

The hull is now ready for the flooring. Turn the hull upside down, and if the sideboards and stringers are not perfectly straight across the edges, plane off until the flooring fits well when laid across the bottom. This detail is an important one, for if a tight joint is not made here, the boat is likely to leak. The floor-boards are now laid across and nailed solidly to the edge of both stringers and sideboards. Begin at the bow and finish at the stern, letting the last floor-board extend beyond the transom about ½ in. and neatly round off the edge.

To prevent any possibility of leakage, it is a good plan to lay a strand or two of candle-wicking along the edge, before nailing the flooring in place. The floor boards must be planed so that the edges

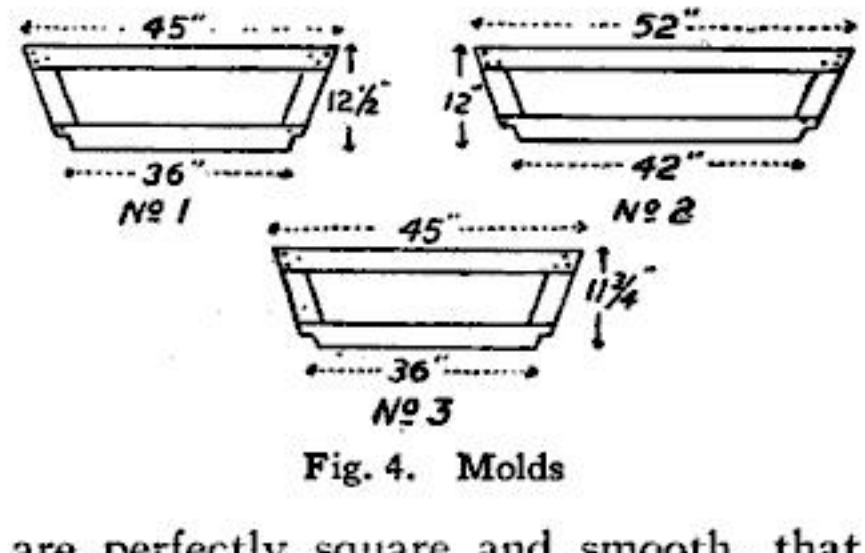


Fig. 4. Molds

are perfectly square and smooth, that each may fit the other as tightly as possible. If this is done, and cedar or white pine lumber free from knots or defects is used, the bottom will quickly swell water-tight. Calking is never satisfactory in flat-bottomed boats, for it is almost impossible to keep it from falling out of the seams. It is unnecessary if the flooring is laid as directed.

After the bottom is on, nail the ⅞ by 6-in. strip of Georgia pine (do not use North Carolina pine, which is an inferior wood), in the center of the outside. This forms the outside keel or shoe and should run from stem to stern. Fasten by nailing from the outside, and clench the nails on the inside, setting in the heads well below the surface. This should also be done throughout the boat, so that putty may be filled in to make a good finish.

The boat may now be turned right side up and the seats and seat-risings put in. The risings are simply ⅞ by ⅞ in. strips, screwed to the ribs the seats resting upon them.

The molds may now be removed.

In the place occupied by them put in a rib, in the same manner you have fastened in the others.

The work of making the centerboard may now be started, which is shown in Fig. 6. First cut the slot in the exact center of the floor, and through the outside keel. Make this slot 2 ins. wide. At each end, put in a post. Nail this post solidly to the flooring and to the keel. The sides of the centerboard trunk are best made of a single board; if two are used, calk the seam.

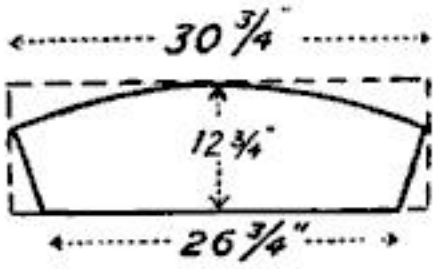


Fig. 5. Transom

The sides are shaped as shown and nailed to the posts. Lay two or three strands of candle-wicking at the junction of flooring and trunk. Finish by nailing a 1-in. quarter-round molding to cover the joint, first laying in a strand or two of candle-wicking. For the centerboard, two pieces of Georgia pine are doweled together as shown in diagram. Galvanized or plain iron rods about ¼ in. in diameter are all right for fresh water, but brass is more durable in salt water. In boring the dowel holes, make them the same size as the dowels, and take particular care to bore the holes straight, otherwise the board will not be true. In the lower left-hand corner of the centerboard, make a 4½-in. slot. Bore a hole through the trunk and hang the board by driving an oak pin flush with the outside of the trunk. Near the after-end of the top edge of the board, drive a staple or screw-eye, and fasten a galvanized iron rod in the eye, so that the centerboard may be raised and lowered. The top of the trunk is finished with a ¼ by 3½-in. oak piece, in which a hole is bored to allow the rod to project through. Screw this in place on the edges, using brass screws.

The deck beams may now be put in, and while many boats are made with a flat deck, it is best to form a "crown" by curving the beams 1½ or 2 in. in the center. For the fore deck, put in three deck beams, running them across and screwing solidly to the ribs. Two beams should be put in to support the stern deck also. To support the side decks, knees should be put in to rest upon each seat, and in between. The deck details are shown in Fig. 8.

The deck is laid in strips, running fore and aft (lengthwise of the boat). Begin by laying the first strip from stem to coaming line; then fit the others as shown in diagram. When ready to lay the side decks, put a few strands of candle-wicking along the top edge of

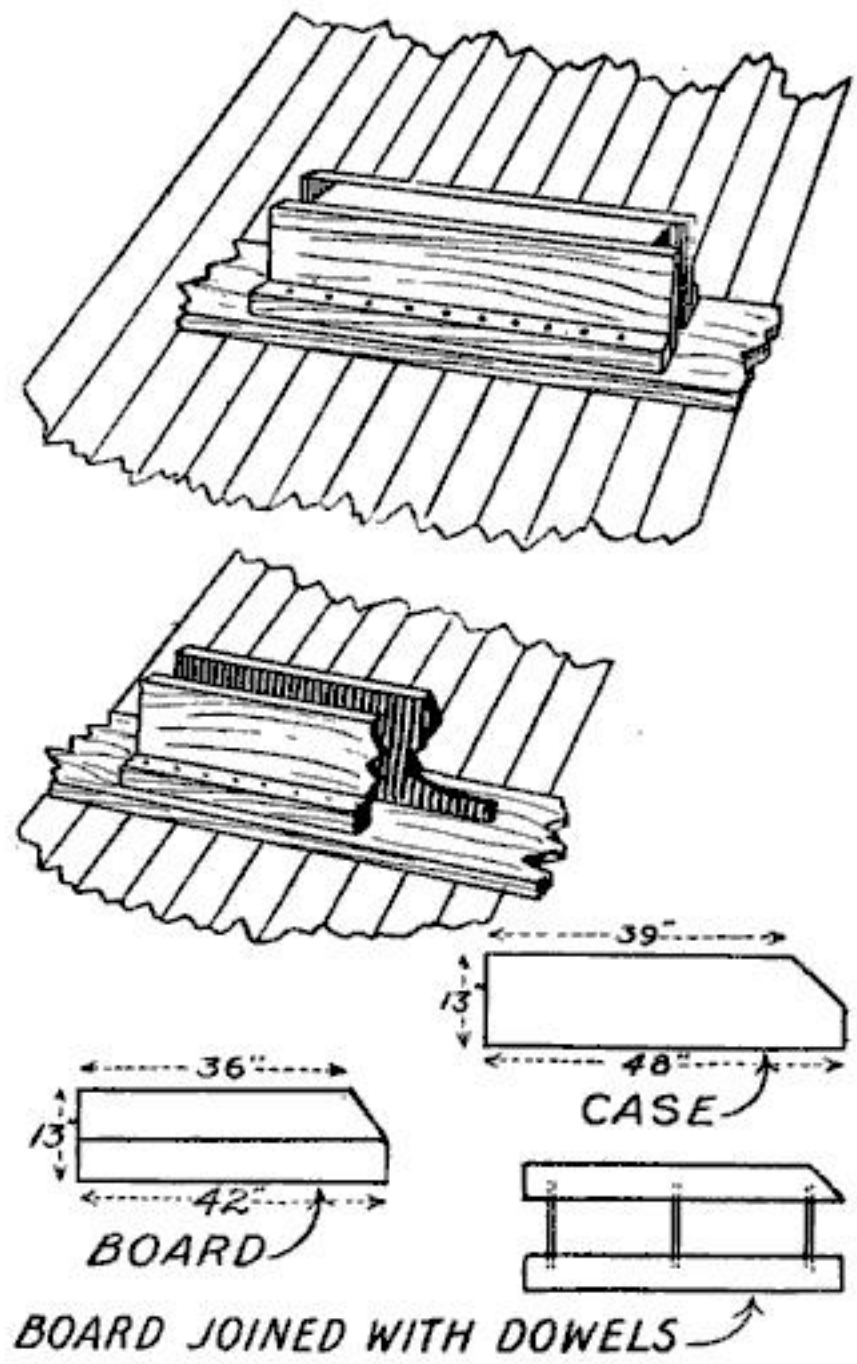


Fig. 6. Centerboard construction

sideboards, and nail the deck solidly to the sides. Screw firmly to the deck beams, countersinking the heads of all screws and nails.

Now that the boat is decked, cut out the inside curve for the coaming of the cockpit. The coaming will not require steaming, if ¼-in. oak is used. Simply bring the forward ends together to form a ∧. A butt-block shaped to fit, is now screwed firmly in place to make a solid joint.

If the deck is carefully laid with tight joints and kept well painted, it will be water-tight, but the usual

practice is to cover the decks with canvas. The canvas may be laid in glue or wet paint, the former being by far the better method. Procure a can of soft, black marine glue and brush it on the deck with an old stubby paint

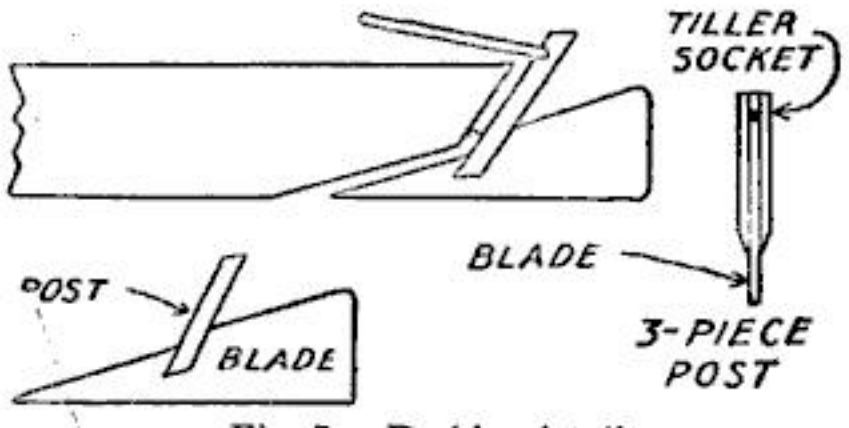


Fig. 7. Rudder details

brush. The glue comes in the form of a thick paste, and will be found too stiff to brush evenly, but spread it as evenly as possible. Now lay the fitted canvas in place and with a moderately hot flat iron, iron the canvas until the melted glue sweats through to the surface. Now pull the edges of the canvas over the sides and tack to the edge of sideboards with copper tacks, spaced close together. Tack the inside edge of canvas neatly to the lower edge of coaming. It is better to use a one-piece deck covering, but it may be pieced by lapping one edge over another about an inch, and gluing in place. Do not use tacks anywhere on the deck.

The row of tacks on the outside edge is covered by screwing on the 2-in. half-round molding which forms a fender-wale. Taper this at bow and stern to make a neat appearance. The tacked inside edge is similarly covered by screwing a ½-in. quarter-round molding around the coaming. On the outside of the coaming, about 18 ins. aft of the middle seat, screw an oar-lock block (made of oak or ash), to both the coaming and the deck.

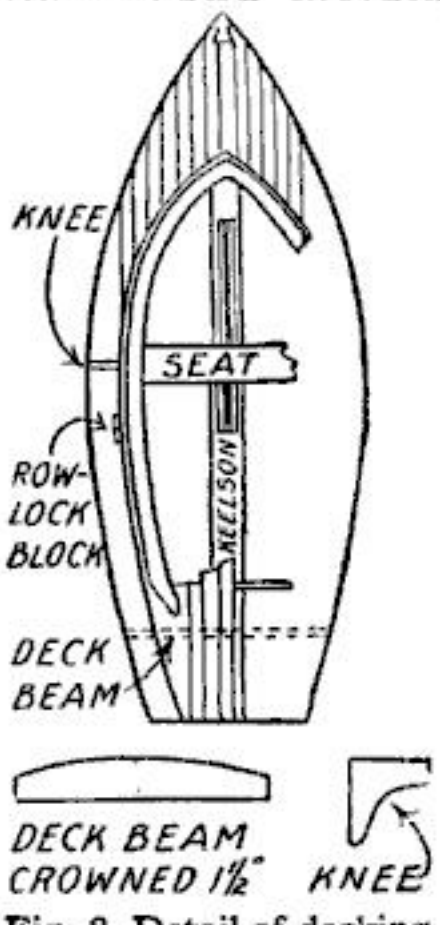


Fig. 8. Detail of decking

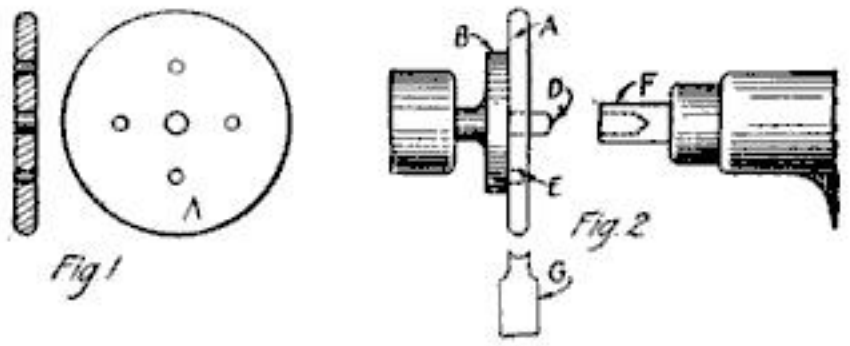
Several types of rudders may be used, but the outside transom form of rudder is preferable to the form using a rubber port. Such a rudder is easily made as shown in Fig. 7.

(*To be concluded*)

Rounding Washers in a Speed Lathe

ROUNDING the edges of washers in large quantities may be accomplished on a speed lathe, by means of an arrangement such as shown in the diagrams. The washer *A*, Fig. 1, is floated on two pins placed on the face of the piece *B*, Fig. 2, which is made to fit into the headstock spindle. The central hole in the washer must fit snugly over the pin *D*. The pin *E* engages with one of the four other holes, but it need not fit tightly.

Fastened in a socket held in the tailstock spindle, is a piece of copper *F*, Fig. 2, being drilled out to clear the pin



Fitting for rounding washers on a lathe

D. When the washer is in position, the copper end is brought into contact with it, keeping it in place.

The tool *G* is used in actually rounding the edges of the washer. Every washer is put on and taken off without stopping the machine. Care must be taken that no chips get between the washers and the face of the arbor, since this will make a bevel on one side and ruin the work.—C. ANDERSON.

Improving Automobile Springs

MANY lightly-built cars of the Ford class will ride more easily if the body springs are taken apart and sent to a polishing shop to be polished off. Here they are first given a rough brushing with a coarse carborundum wheel, after which they are polished to a bright luster, greased, and colored. After this treatment, the springs should be kept lubricated, and they will be found to work very smoothly.—R. W. TILLOTSON.

Boring a Hole in Glass

WHILE the Wimshurst static machine is one of the most easily constructed mechanisms of its kind, no doubt a good many amateurs are prevented from constructing it through the mistaken notion that the glass plates are difficult to drill. This is by no means the case, provided one has

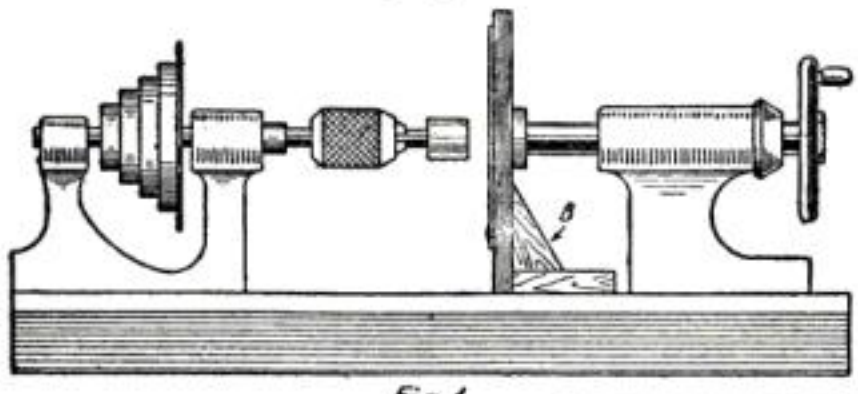


Fig. 1

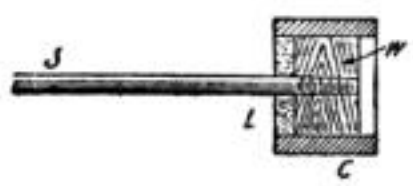


Fig. 2

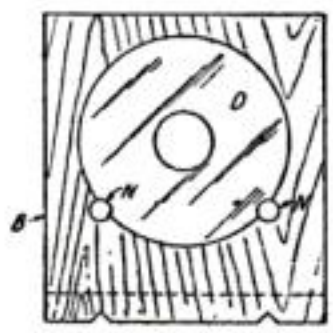


Fig 3

Arrangement for boring hole in glass by means of a lathe

access to a lathe. The difficult part is not in cutting the disk, since any good glazier can do that; but in cutting the hole in the center, for fitting the hub on the machine.

Excellent results can be obtained with the following scheme: Into a piece of copper tube *C*, Fig. 2, the size of the hole wanted in the glass, drive a block of wood *W*. This must be a driving fit. Then screw a 5/16-in. wood screw *S* exactly in the center of the wood block, as shown, and cut off the head. In order to hold the screw in place, it is advisable to tin the shank of the screw and the edge of the copper tube, and fill it with solder, as shown at *L*, Fig. 2. This is our boring tool. Next, make a bracket (*B*, Fig. 1), that will slide on the lathe-bed plate. This may be made of wood. Place a center in the chuck and slide the bracket *B* against it, so as to mark the exact center. Remove the bracket from the lathe, and with a pair of dividers, draw a circle the size of the plates which are to be bored.

Drive two nails on this circumference, as shown at *N*, *N*, Fig. 3. Now replace the bracket in the lathe, and place the boring tool in the chuck as shown in Fig. 1. Place the glass plate on the nails *N*, *N*. If all this has been carefully done, the plate will be perfectly centered. Now move the bracket so that the glass plate just touches the boring tool, and exert a gentle pressure with the tailstock.

The cutting is done by applying oil and emery. Since the copper is very soft, the emery becomes embedded in the tube and thus forms an excellent cutter. A rather slow speed is desirable. The best way to apply the emery is to put it in an oil-can with a rather large opening and squirt it into the cut.

It is well to relieve the pressure from time to time to allow the emery to work into the cut. By this means a very clean hole can be cut, and the result will well repay the trouble involved in the making.—E. C. MEILLORET.

Making Shrinkers

IN making the part shown in the illustration, much time, as well as steel, may be saved by shrinking on the piece *A*. Make the shrinkers from a piece of extra-heavy 1-in. pipe, having the required outside diameter. The use of pipe obviates the cost of making shrinkers, and a 1-in. drill just cleans out the hole. Cut the pipes into the required lengths, leaving a little extra for facing, and then drill them. When a long pipe is drilled and then cut up, a burr is left at each end, which is difficult to remove.

In Fig. 1 is shown a device, which is very handy for shrinking a piece to be located at some special point. A piece of steel, which has been drilled out and hardened for use in hammering on the shrinkers, is shown in Fig. 2. It will not crack or splinter like an ordinary piece of pipe.—C. ANDERSON.

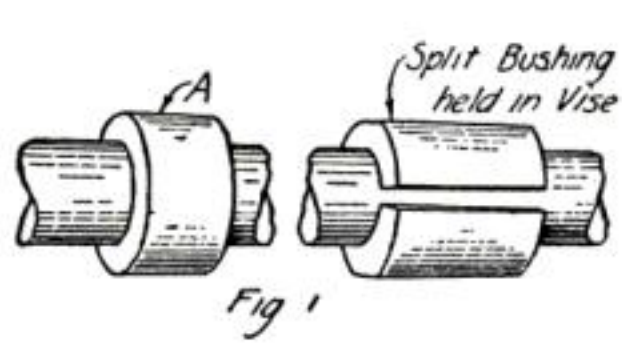


Fig 1

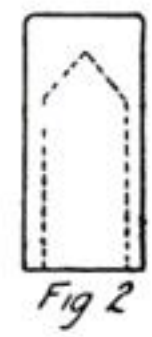
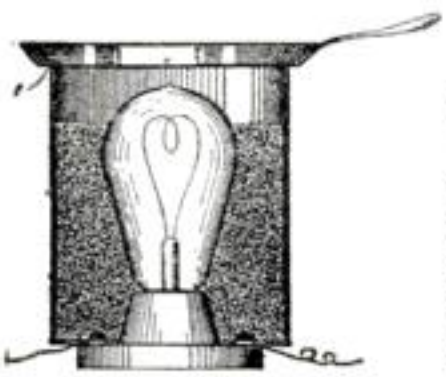


Fig 2

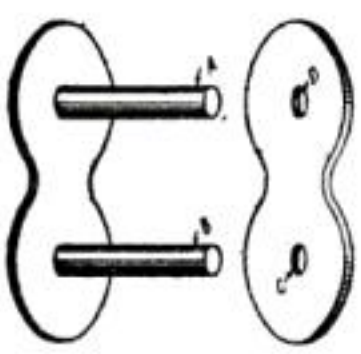
Device for shrinking a piece of piping into place on a shaft

Frying Eggs by Means of an Incandescent Bulb



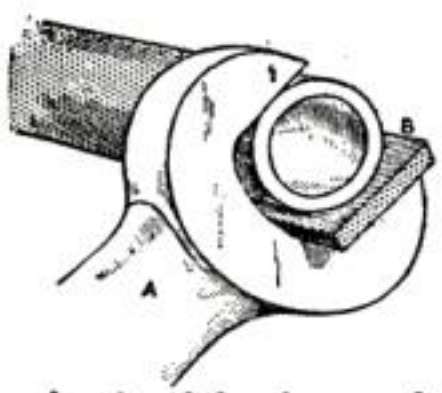
AN ordinary incandescent bulb, together with some sand and a tin can, can be used for frying eggs to suit the taste of the most critical. Procure a can large enough so that a space of ¼ in. will remain between its sides and the bulb at its widest part. Cut a hole in the bottom of the can to fit an electric socket. Screw in the bulb and fill the can with sand as shown. Place the pan on the top of the can and be sure it fits tightly. Turn on the current; in a very few minutes sufficient heat will be generated to cook the eggs. If left longer, the sand and glass will become almost red-hot.—WM. HARRIER.

An Easy Way to Punch Holes in Clock-Spring Steel



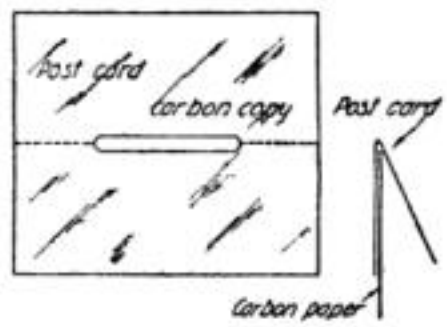
THE diagram represents an instrument that will be found handy for punching holes in spring-steel, such as a clock-spring. It consists of a link from an automobile chain, one pin of which *A* is filed flat like the end of a punch. By placing the steel spring over the hole *D* and entering the pin *B* in hole *C*, a sharp blow with a hammer over *A* will cut a clean hole through the spring. Being of steel, the pins *A* and *B* may easily be hardened.—M. F. VANDERSDALE.

An Improvised Pipe-Wrench



A PIPE-wrench can be improvised from a solid wrench *A* and a coarse, sharp file. The file *B* is placed in the lower jaw and raised with slugs of metal, if necessary, until the desired grip is obtained on the pipe between the upper jaw and the file surface. This expedient will prove of value in an emergency.

A Carbon-Copy Postal Card

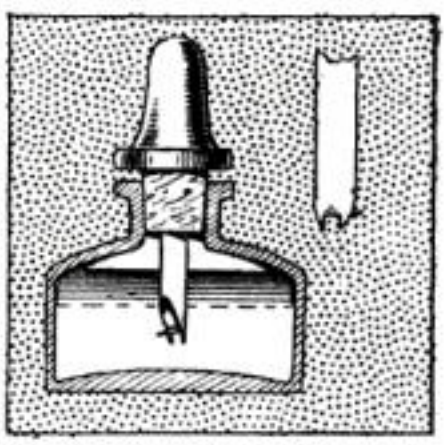


A POSTAL card, similar to the regular double card used for a return message, may be used for making a carbon copy. The carbon is slipped between the two folds of the card in writing; then the copy is torn off along the central perforated line.

For this purpose a comparatively thin card is required.

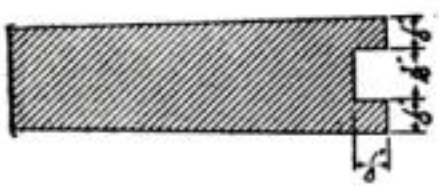
This scheme is especially valuable to clubs and business houses who have to send out hundreds of short communications.—F. P. MANN.

Improving a Drawing-Ink Bottle



THE quill, usually attached to the stopper of a drawing-ink bottle, necessitates several dips into the ink before a sufficient quantity is obtained for transferring to an instrument. By slitting the quill on both sides of the point and standing it on the point, with a heavy object bearing down on the stopper, the tip becomes horizontal, forming a small cup, which will retain a large quantity of ink.—C. NIELSEN.

Hints to the Mortor-Cyclist



THE appearance of old and rusted cylinder heads can be greatly improved by applying ordinary stove polish with a small brush.

Bent crank-hangers can be straightened by putting a piece of one-inch pipe over the end of the hanger and exerting a little pressure.

A wrench for the bolts in the crank case can be made by grinding or filing a screwdriver bit into the desired shape, as shown in the diagram. The bit is then placed in the brace and used like a socket-wrench.—E. H. DODGE.

A Bow-Drill for the Work-Shop

THE bow-drill about to be described will be found a most useful addition to the average amateur's workbench, and although the size of the drills somewhat restrict its field of usefulness, it will be found invaluable in the construction of certain classes of apparatus.

The handle should be turned first, preferably from good ash stock. It is perfectly straight in diameter and 5¼ inches long. One end tapers in to ¾ inch. A ⅝-inch hole should be bored in the other end 3⅛ inches deep; this serves as a magazine for the drills.

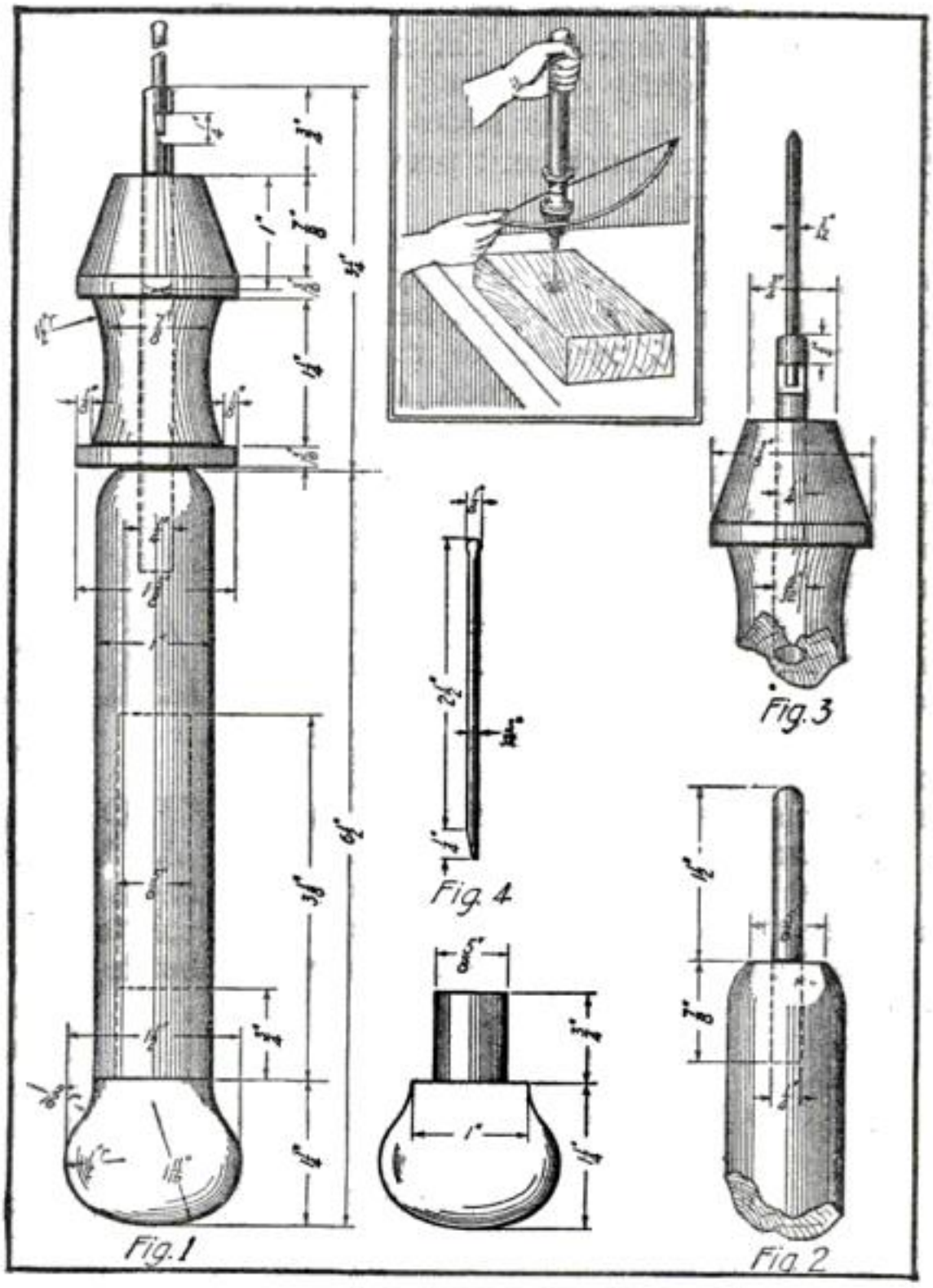
The next step is to turn the knob or breast-piece. This is 2 inches long and 1½ inches at the widest point. One end is rounded off as shown in the diagram, while a shank ¾ inch long and ⅝ inch in diameter is turned on the other end. This fits the magazine and serves as a stop for it and as a breast-piece for the drill.

The next step is turning the spool, the dimensions of which are given in Figs. 1 and 3 of the diagram.

The chuck is next made. This is of iron or soft steel ¼ inch in diameter and 1¾ inches long. A slot ¼ inch long is filed in one side ¼ inch from the end; the upper side being filed 11/64 inches deep, while the lower side is filed 5/64 inch deep. A hole is next bored endways into this slot slightly larger than 3/32 inch; the other end is embedded into the end of the spool for one inch of its length and should not turn. A 9/32-inch hole should be bored in the other end of the spool up to the end of the chuck. This should be done before the chuck is put in so that the spindle will bear directly on the end of the chuck. This reduces the friction.

The next step is to embed the steel spindle in the handle. This had best be of steel, ¼ inch in diameter and 2⅜ inches long. One end should be slightly rounded, while the other is tightly embedded in the handle for ⅞ inch of its length. The spool on this spindle should rotate freely.

The drills are next made and are easily and cheaply constructed from the ribs of an old-fashioned umbrella. These ribs are of the finest spring steel. To make the point, cut the wire to the desired length, say about 3 inches, as this is long enough for average work.



Construction details of a bow-drill adapted for actual workshop use

Then heat the tip to a cherry red and hit it a sharp blow with a hammer to flatten it slightly, and quickly dip into cold water. This gives about the proper degree of hardness. The necessary clearance was given when it was flattened, and the point is then ground down until the flat side is very nearly a half-round and the narrow side tapers to a point at an angle of 30 degrees. The other end is filed off slightly on a long angle, as shown in Fig. 4. This slides up upon the slot in the chuck and prevents the drill from turning.

The bow is made of some limber wood, such as elm or hickory, and is trimmed down so that when bent it will give the desired tension to the string. This depends on the wood used and should be sufficient to keep the cord from slipping when twisted once around the spool. The bow used with the drill described was 2½ feet long, ¾ inch wide and ¼ inch thick. The cord should be of leather attached to one end and about 6 inches above the other end, which was left for a handle.

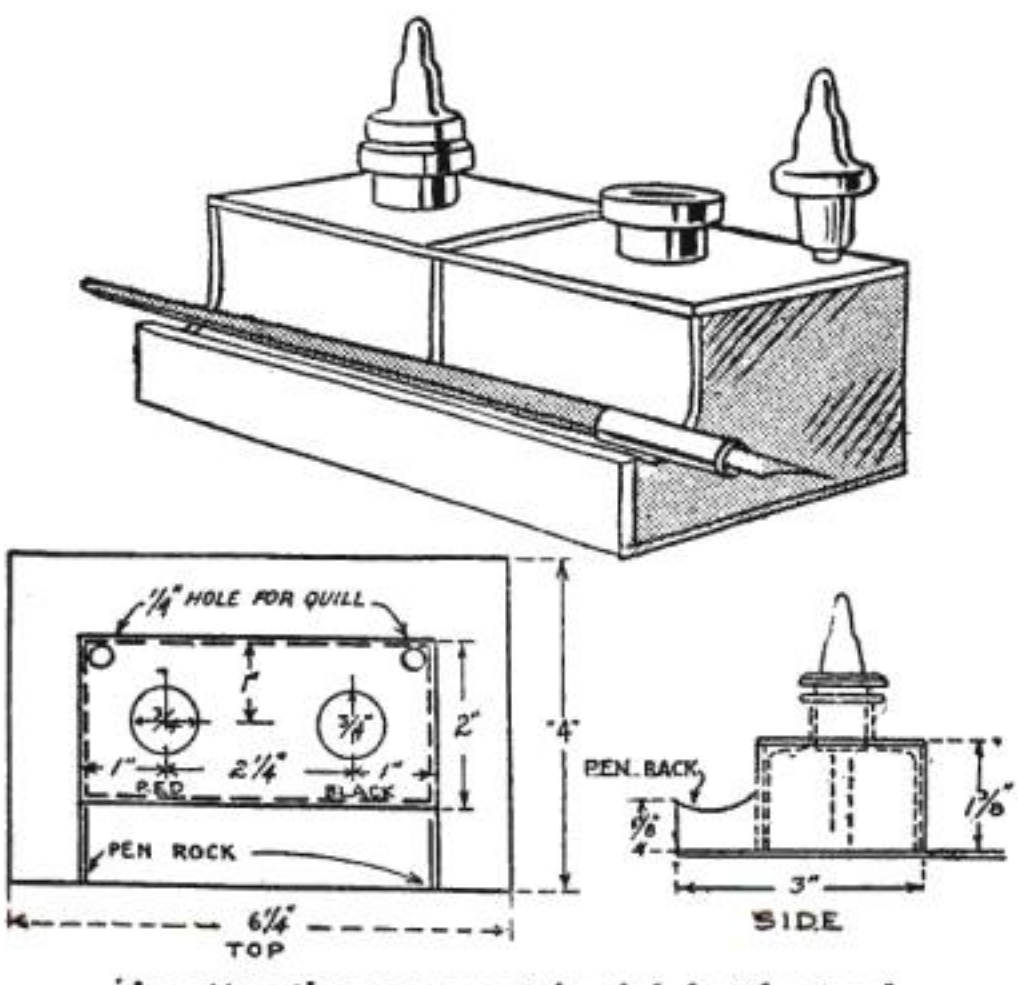
The chuck described here is expressly made for the wire drills, but if the maker has any other drills that bore with a backward and forward motion, he could use any design of chuck he wishes in order to accommodate the drills.

This bow-drill, if the points are well ground, will quickly bore wood or iron and if supplied with turpentine will even bore glass. When needed, the drills can be made longer, but when the length is over 6 inches care must be taken or they will bend when pressure is exerted on the handle. To rotate the drill, the bow-string is twisted once around the spool and the bow is then pushed rapidly backward and forward at right angles to the handle.—Rae McGooch.

The bottle will glow with the sparks which fill it

The Luminous Bottle

TO perform this experiment, fill a big bottle nearly full of water and run a wire from one terminal of a spark coil to the inside of the bottle. Set the bottle on a plate of glass to insulate it from the table. Then run a wire from the other terminal and tie it securely around the bottle about half way up. When the spark-gap is started, little sparks are given off from the wire to form a fine network all about the bottle.—F. M. Kimble.



An attractive non-upsetting ink bottle stand

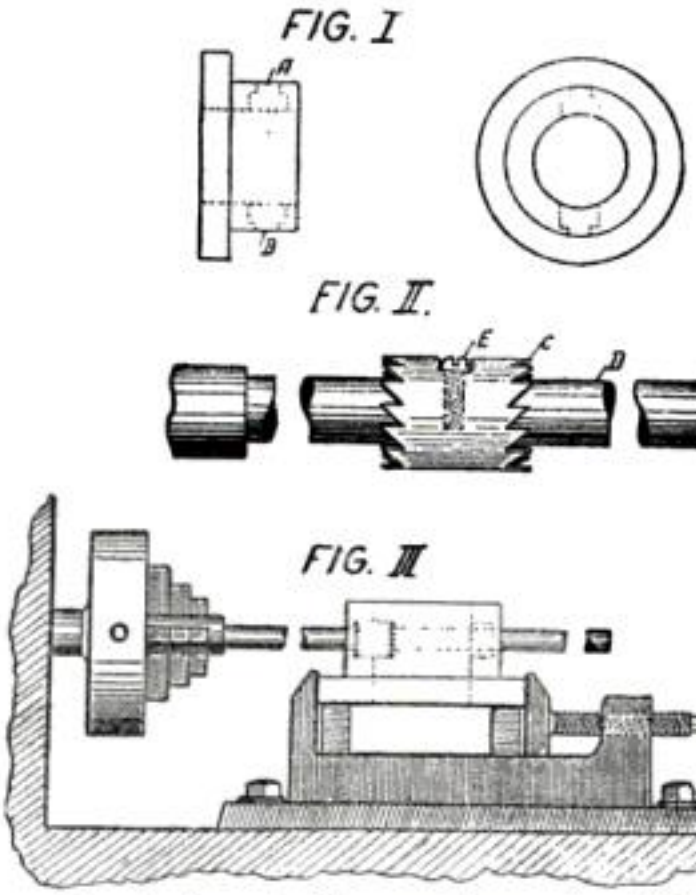
Non-Upsetting Holder for Drawing Inks

AN ink stand that will not upset, owing to the broad base secured, can be made according to the dimensions given in the diagram. The base should be cut first and the sides fitted afterwards. Cigar box wood will do. The two end pieces should protrude in front of the bottles and the upper surfaces should be whittled out for pens.

Inside Counter-Boring in a Miller

THE problem of securing the counter-bore shown in Fig. *I*, may be solved by means of a cutter *C*, shown in Fig. *II*. This cutter is made for left and right, for use in a milling machine running only in one direction. It is a snug fit on the shank *D*, one end of which is held in the chuck, as shown in Fig. *III*. The small diameter of the shank is a few thousandths of an inch smaller than the hole, which is drilled through the sides of the work, shown at *A*, Fig. *I*.

The method of holding the work is shown in Fig. *III*. After being placed in the vise, it is lined up with the end of the shank, which is held in the chuck. The cutter is then placed between the sides and the table moved inward. This runs the cutter on to the shank to which it is fastened by means of the screw *E*.—C. ANDERSON.

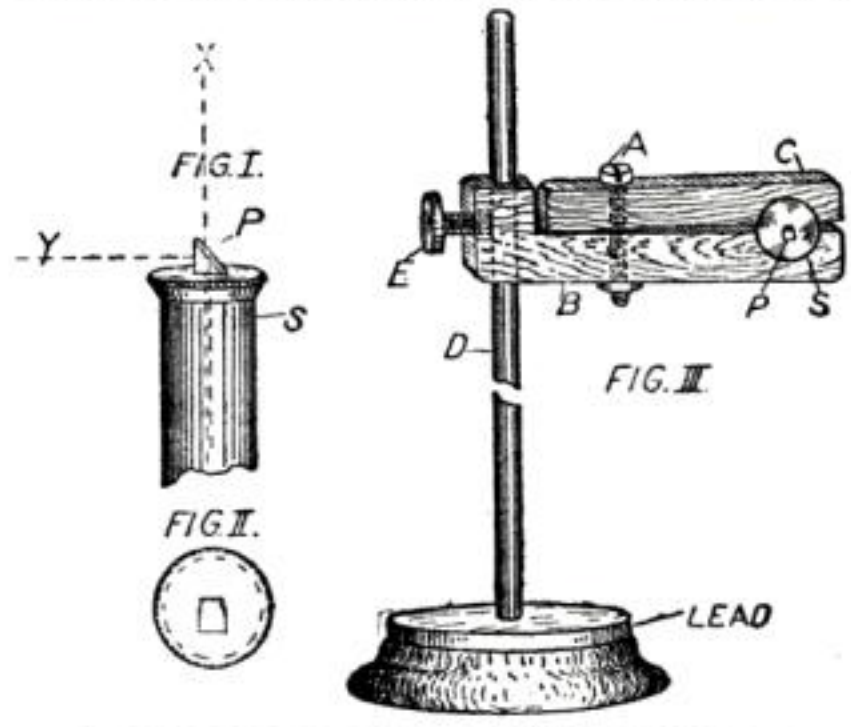


A solution to the problem of getting the counter-bore shown in Fig. I

How to Improve a Pocket Spectroscope

SMALL direct-vision spectroscopes are very popular with many amateur experimenters and are comparatively inexpensive. The utility of an instrument of this type can be greatly increased by a few simple improvements which can be made by anyone who is handy with tools.

The most important addition is that of a comparison prism, whereby light from two sources can be viewed simultaneously and the spectra compared. This is shown in Fig. *I*. A small right-angled prism *P*, with ¼-inch sides, is fixed at the slit end of the spectroscope

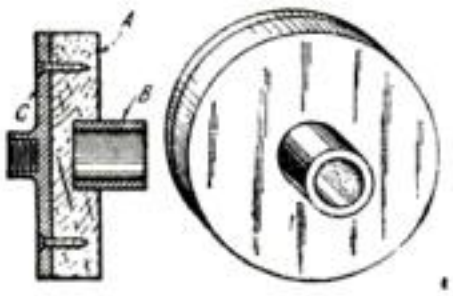


A comparison prism can be added to a pocket spectroscope with little difficulty

S, the position being carefully adjusted so that exactly one-half of the narrow slit is obscured, as shown in Fig. *II*. Strong isinglass cement, or an alcoholic solution of shellac, may be used as an adhesive and will be entirely satisfactory, if the instrument is carefully handled. Light proceeding from a source *X* immediately in front of the spectroscope, will pass directly through the uncovered half of the slit; while light coming from the side, as at *Y*, and entering the prism, will be refracted at right angles to its former direction and made to pass through the covered half of the slit. In this way two spectra can be seen, one above the other, and compared.

It is a great convenience to fasten the spectroscope to a stand, thus leaving both hands free. A simple stand that can be constructed without difficulty, is shown in Fig. *III*. The spectroscope *S* is gripped between two wooden blocks *B* and *C*, hollowed out at one end. A gentle grip is all that is needed. This can be secured by the use of a small brass bolt *A*, passing loosely through large holes in both blocks. The lower block *B* is perforated at the end to slide up and down a rod *D*, fixed upright in the center of a wooden base. A thumb-screw *E*, serves to hold the block at any desired height. To make the stand steady, the base should be weighted with lead.—H. J. GRAY.

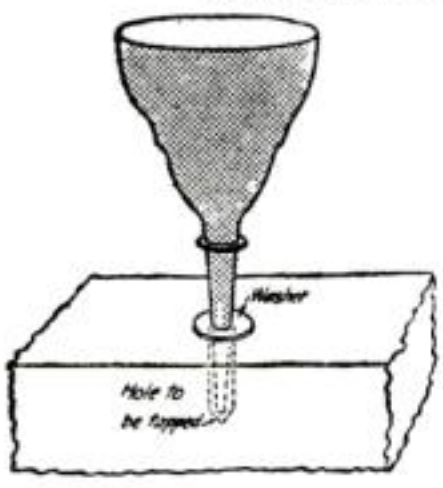
A Lathe Polishing Kink



TO polish small round boxes, napkin rings, and the like, after they have been taken from the lathe, take a board, *A*, and with an expansion bit bore a hole the size of the object to be polished, *B*, and place it in this hole so that part of it projects.

Screw the board to the face-plate, *C* and put it on the lathe. The edges of the board may be turned down with a chisel and the object given its final smoothing and polishing without gripping it in metal.—R. F. CUMMINGS.

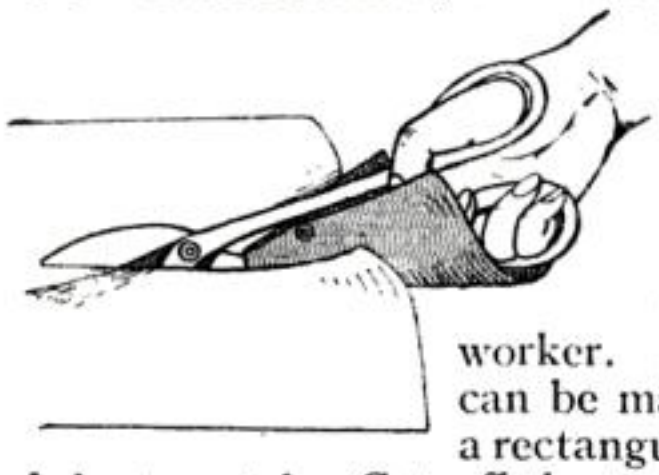
Tapping Blind Holes



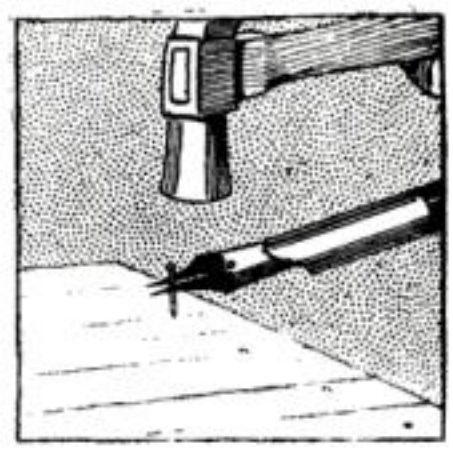
BEFORE tapping blind holes, much time and trouble can be eliminated by first making sure that the holes have been drilled to the right depth. This is done by placing a leather washer on the spout of an oil-can so that the end will just touch the bottom of the hole, the washer resting on the face of the work.—C. H. ANDERSON.

How to Cut Metal and Not Cut Yourself

WHEN making a long cut in a strip of sheet metal, the metal is likely to bend up behind the shears and cut the hand of the worker. A guard can be made from a rectangular piece of sheet metal. Cut off the two corners of one end and bore two holes as shown in the diagram. Bend the smaller end along a longitudinal line through the middle. Fasten to the bottom handle of the shears by means of a small bolt. —J. LIEBMAN.

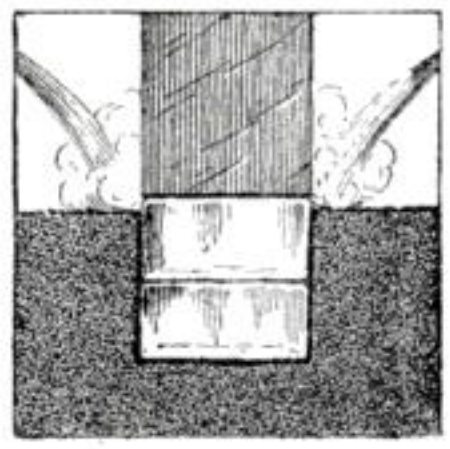


Handling Small Brads



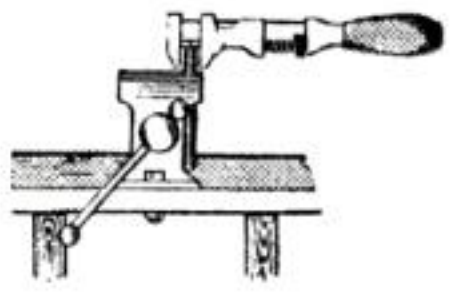
AN ordinary pen greatly facilitates the handling of small brads or pins. The brad should be placed between the blades of the nib and then hammered in part way, after which the pen may be removed.—JOSEPH BRAFF.

Using Ice to Lower Heavy Stones



THE placing of finishing stones, weighing several tons, is often difficult because spikes cannot be used, owing to the position of the stone in the building. The stone can be easily lifted to the desired level with ropes, but it cannot be lowered with them, since they would wedge in the sides. By placing several cakes of ice in the hole, the stone can be lowered on to them, directly above the opening. Streams of hot water will melt the ice and let the stone sink into place easily.—A. J. COWEN.

An Emergency Pipe-Cutter



PIPES of brass or other soft metal can be threaded with a lock-nut of the proper size. A lock-nut is cut at opposite places across the threads, the two threaded halves thus formed comprising a very crude pipe-cutter. The pipe should be held by a vise and the nut gripped with a monkey-wrench.—C. A. FAIMAN.

Whistle on Engine of Motor-Boat

A WHISTLE in place of the pet-cock or priming cock, of a twin cylinder marine engine will be of use in signaling from a motor-boat.

Experimental Electricity

Practical Hints for the Amateur

Wireless Communication

Damping in Radio Circuits

By John Vincent

THE subject of damping and "logarithmic decrement" of current and voltage in radio telegraph senders and receivers is often looked upon, by the wireless experimenter, with a certain degree of awe. This is usually because many of the text-books and articles treat the matter as though it were very complicated and hard to understand; the fact is indeed the contrary, and the matter of damping is not at all difficult to grasp. There is no need of making use of long mathematical expressions to figure out how much damping exists in any circuit, and what damping itself means.

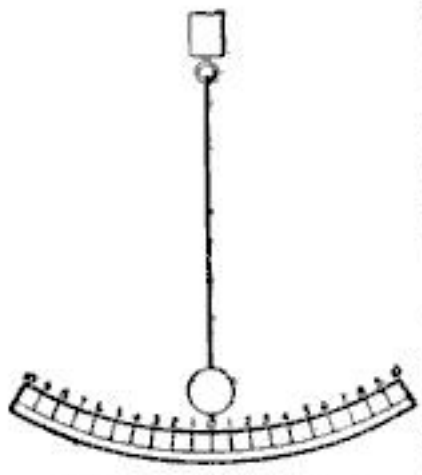


Fig. 1. Pendulum with circular scale

In the first place, it must be understood that in speaking of the damping of an alternating current one refers merely to the rate at which the current oscillations die away. If the oscillations die away fast the damping is said to be high, or if, on the contrary, the oscillations persist a long time before fading out, the damping is feeble. A pendulum having a freely pivoted joint at the top, and swinging through the air, will vibrate back and forth many times before coming to rest; its oscillations, which are, of course, mechanical, are then feebly damped. But if the same pendulum is immersed in water it will stop swinging much sooner, because the friction of the water offers resistance to its motion; in this condition the damping is higher. If the pendulum is lowered into a tank of heavy oil or molasses the friction will be greater still, and the oscillations will die out very quickly; thus the mechanical system becomes highly damped.

If we arrange the pendulum with a circular scale and pointer, as shown in Fig. 1, it becomes a simple matter to measure its period and damping. To find its period it is only necessary to draw the bob to one end of the scale and let it go, counting the number of complete swings it makes in one minute. The length of time taken for one complete swing from left to right and back, measured in seconds, is equal to sixty divided by the number of swings in one minute; this division gives the time period of the pendulum. For instance, if the bob is swung out to the left and let go at the beginning of the minute of timing, and if it swings back to the left side thirty-six times and is at the right-hand end when the minute is up, the period will be 60 divided by 36.5, or 1.64 seconds. By lengthening the cord or rod a little, the period could be made exactly 2 seconds, or by shortening it, 1 second. For the illustration of damping measurement given below it is useful to make the pendulum about 39 ins. long, which will make the period about 2 seconds. The cord may

be lengthened or shortened, as required, until, by a number of successive measurements, it is shown that the time of making one complete swing is two seconds. To measure the damping it is not necessary to have the period any specific length of time, but the plotting of oscillation curves of the pendulum is made easier if some simple number is chosen.

This plotting of the oscillation is an interesting and useful preliminary to the determination of the damping of the pendulum. Suppose that the period has been adjusted to 2 seconds, and that the scale along which the pendulum-bob swings has been marked off into 10 equal parts on each side of the middle or zero position. Let the bob be drawn to the left and held at the tenth division;

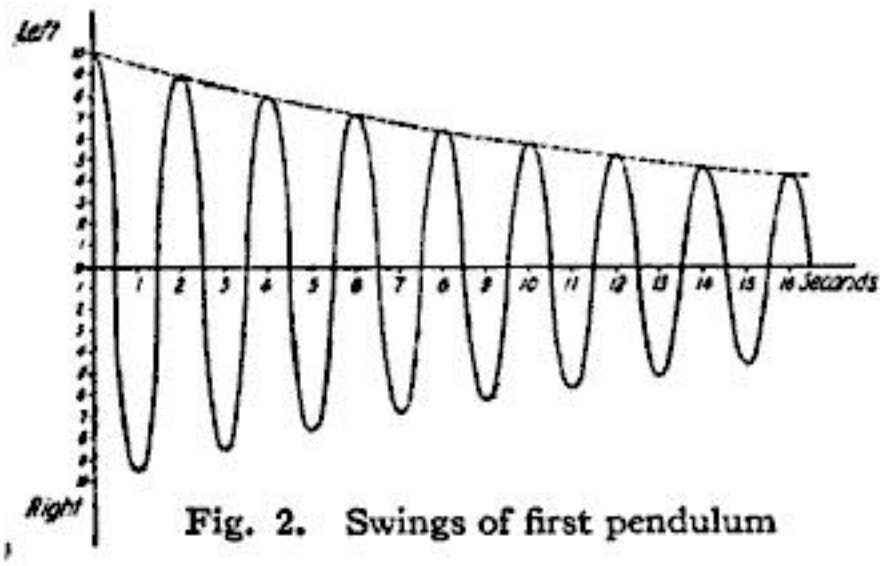


Fig. 2. Swings of first pendulum

if it is released it will reach the lowest point (zero) in exactly ½ second and will swing out to the right side. At the end of 1 second it will reach the end of the swing to the right and will be on the point of returning. At the end of 1½ seconds the bob will be again opposite the zero point, and at the end of 2 seconds it will be at the end of its first complete period and about to swing to the right in beginning the second period. The important thing to note is that although the bob started at 10 on its scale, it did not swing so far to the right but instead commenced to return at the point indicated by about 9.5 on the scale. At the end of the first complete period it swung out only about as far as 9 on the left; at the next complete period it swung only a little beyond 8. If one watches the extreme reach at the end of each swing very carefully, it becomes possible to make a table of the successive turning points. For a certain pendulum these may be as follows:

Time in Seconds	*Position of Bob*
0 (start)	10 left
0.5	0
1	9.5 right
1.5	0
2 (end of first period)	9.0 left
2.5	0
3	8.6 right
3.5	0
4 (end of second period)	8.1 left
6 (end of third period)	7.3 left
8 (end of fourth period)	6.6 left

and so on. At the end of each half second the bob would be at zero, and at the ends of the fifth, sixth and later periods, at the following values of the scale to the left: 5.9; 5.3; 4.8; 4.3; 3.9; 3.5; 3.1; 2.8; 2.5; 2.3; 2.0; etc. By drawing a horizontal line to represent time in seconds and by dividing the space above and below it into ten equal zones, above for swings to the left and below for swings to the right, the diagram of Fig. 2 may be drawn by measuring off the points given in the table (or those measured from your own pendulum). This diagram represents the actual movements of the suspended weight, and by drawing a broken line through the highest points one can get a good idea of how fast the swings die away, or, in other words, of how great the damping is.

The most interesting thing about the figures determined by the above experiment is that the ratio of the successive measurements or amplitudes of swing remains a constant quantity. This may be proved by taking the ratios of the swings at the ends of each period; the first ratio is $10/9 = 1.1$. The second is $9/8.1 = 1.1$. The third, $8.1/7.3 = 1.1$. Likewise, all the others may be found to be equal to 1.1, since it is a law of nature that all simple free oscillations in any vibrating system (whether mechanical or electrical) will die away or be damped out at such a rate that the ratio of their successive maximum amplitudes remains constant. This ratio of amplitudes is a measure of the damping, and is called the damping factor. The larger the ratio the higher the damping.

Suppose that the wind friction of the pendulum shown in Fig. 1 is increased

by fastening to it, near the bottom, a fairly large piece of cardboard, in such a way that it will act as a brake. The swings of the pendulum will die away much faster than before; that is, the damping will be increased on account of the increased frictional resistance of the fan. On such a more strongly damped pendulum (assuming that the oscillation is started by letting the pendulum begin from the point 10), the successive maximum swings to the left (at the ends of the first, second, third and later periods), may be as follows: 8.0 (end of 1st); 6.4 (end of 2nd); 5.1 (end of 3rd); 4.1; 3.3; 2.6; 2.1, etc. It is seen at once that now the swings decrease much more rapidly. This is even more vivid when Fig. 3, which shows the motions of the second pendulum, is inspected: the rapid fall of the broken line along the top, which indicates the damping, should be noted especially. The constant ratio or damping factor, whose value is an indication of the damping, may be found as before by dividing the first maximum amplitude by the second, the second by the third, etc. This gives us: $10/8=8/6.4=6.4=5.1=\text{etc.}=1.25$. Since this ratio is larger than before the brake was added to the pendulum, we have an arithmetical proof that the damping is larger.

So far we have considered only the "damping" of the oscillation system; what is the "logarithmic decrement?" Nothing more nor less than the natural logarithm of the constant ratio which has just been figured out. These logarithms, or special numbers, for several different ratios, are given in the following table:

Ratio	*Logarithm*
1	0.00
1.05	0.05
1.11	0.10
1.16	0.15
1.22	0.20
1.25	0.22
1.28	0.25
1.35	0.30

By looking up the ratio 1.1, which was that of the first pendulum, in the table it is seen that the logarithmic decrement of that arrangement was a trifle under 0.1 per period; similarly, for the second pendulum (which had a damping factor of 1.25), the decrement is found to be 0.22 per complete period.

Although the examples just given are purely mechanical, damping in electric circuits is of the same character. Let us consider the circuit of Fig. 4, which has connected in series a condenser C,

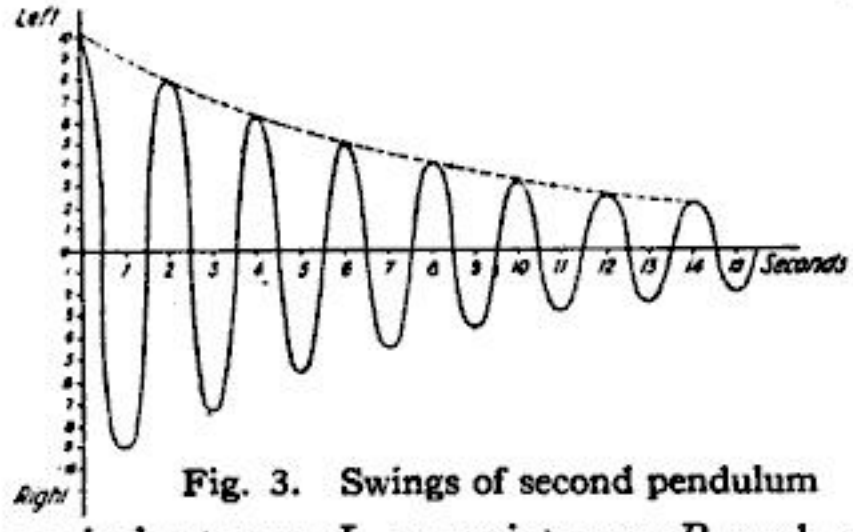


Fig. 3. Swings of second pendulum

an inductance L, a resistance R and a special current indicator I. This indicator is of the sort which will show the amount and direction of the current flowing through the circuit at any instant, as would a Braun-tube oscillograph. If C is charged to a certain potential and then is allowed to discharge through the oscillation circuit by the sudden closing of switch S, the result will be a free oscillating current through L, I and R. As was shown in the March article of this series, the frequency and time period of this free oscillation can be figured out from a simple rule, if one knows the inductance and capacity of the circuit. The thing important to this discussion is not the period of frequency, however, but the rate at which the free oscillation dies away. If the oscillograph I is arranged to make an actual photograph of the oscillation current-effects (which is entirely feasible, even on very high frequencies), the result will be a curve of the sort shown in Figs. 2 and 3; if the capacity and inductance, or either of them, are increased, the time period will be lengthened and the curves will spread out more along the horizontal line. If the voltage applied to the condenser before the switch S is closed is made larger, the current flowing will be increased and the highest and lowest

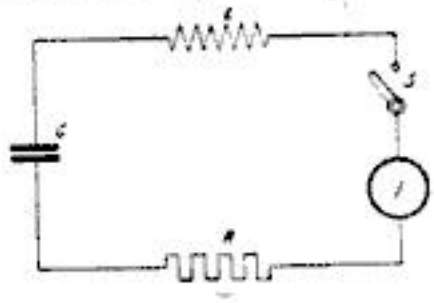


Fig. 4. Oscillograph Circuit

points (the maxima) of the curves will be farther from the zero line. If the resistance in the circuit is increased, there will be fewer oscillations before the current dies away to a small value; that is, the damping will be increased. These three electrical effects correspond in the mechanical case, to changing the length of the pendulum string, pulling it farther from zero before releasing it, and putting on the fan to increase the wind-resistance.

If an oscillogram made in this way,

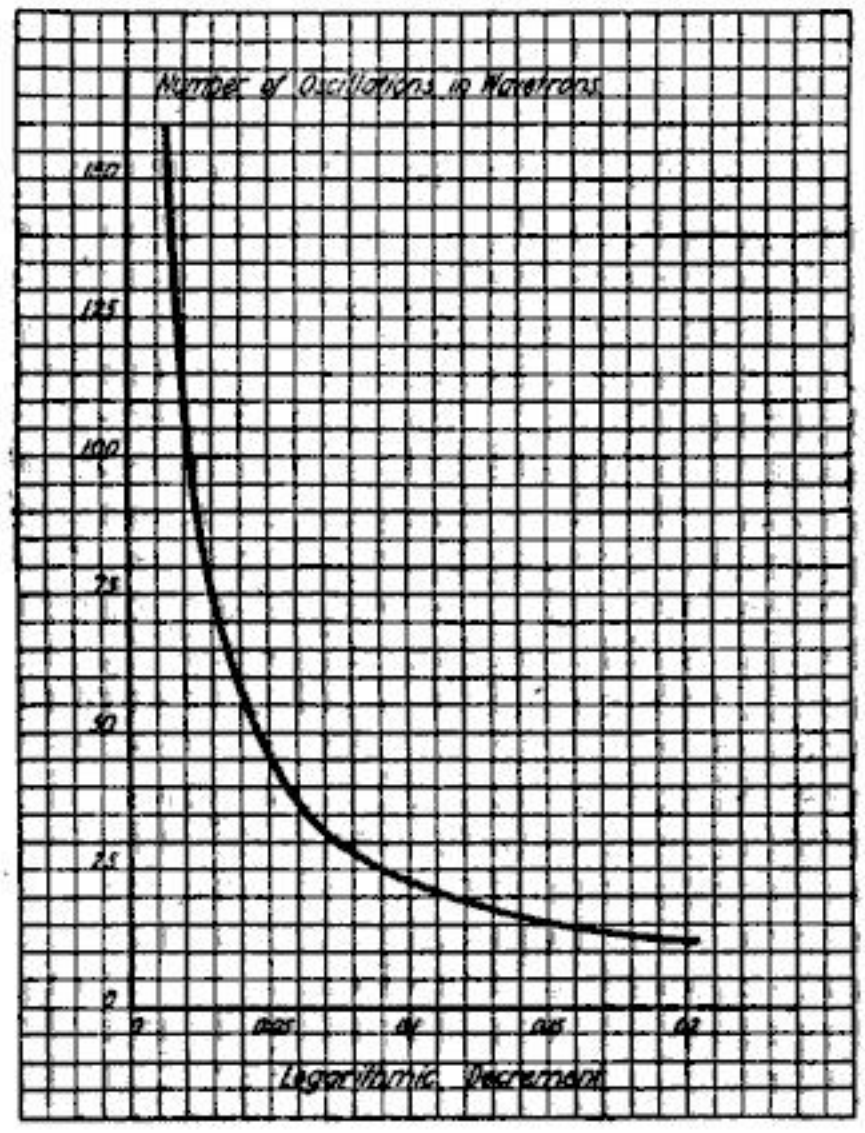


Fig. 5. Oscillation for various decrements

showing the free oscillatory discharge in such a circuit as indicated by Fig. 4, is measured with a pair of dividers, it is found that the ratio of the maximum amplitudes remains constant. Just as with the pendulum, the logarithm of this ratio may be taken and thus the logarithmic decrement of the circuit determined. If the ratio (or damping factor) is found to be 1.05, the table above shows the decrement to be 0.05 per period. If the ratio is made as large as 1.28 by increasing the resistance, the decrement is increased to 0.25 per period. The numerical range of decrement values for circuits used in radio telegraphy is very much the same as that of mechanical vibrating systems; the electrical oscillations in an ordinary spark sender for radio will die away at about the same rate as the mechanical oscillations of a springy steel rod held in a vise. There is a variation of decrement values in wireless transmitters from about 0.03 to about 0.5 per period; the present laws of the United States require that the logarithmic decrement shall be 0.2 or less, since otherwise there are so few oscillations in a wave-train that tuning is not of very great value.

If every time it was desired to measure the damping of a circuit one had to set up a high-frequency oscillograph and make a photograph of the free oscillation, and then measure the amplitudes of the current maxima from that and finally compute the ratio and the logarithm, there would be very few such measurements made. It happens that since the damping in any circuit depends upon the effective capacity, inductance and resistance of that circuit, one may compute the decrement directly from known values of those quantities. The rule is not complicated; it merely states that the logarithmic decrement of any simple circuit may be found by the following four steps: (1) Divide the effective capacity, in farads, by the effective inductance, in henrys; (2) take the square root of this result; (3) multiply this root by the effective resistance in ohms; and (4) multiply this product by 3.14; the answer is the logarithmic decrement, per complete period, of the circuit in question.

This rule for computing decrement may be applied to a simple circuit, for example that of Fig. 4. Let us assume that the effective capacity is 0.001 microfarad, which equals 0.000000001 farad; the inductance may be 0.01 millihenry, which is 0.00001 henry; and the resistance we may assume as 3 ohms total. Following out the rule, the first step gives 0.0001 as a preliminary result; the square root of this is 0.01; multiplied by 3 this becomes 0.03; and multiplying again by 3.14, the logarithmic decrement is found to be 0.095 or a trifle under 0.1 per complete period. It is often difficult to measure the three quantities resistance, capacity and inductance in an oscillating circuit in

such a way as to get their true effective values. The relation expressed by this rule is used often to determine the resistance when the damping, inductance and capacity are known; to do this, the damping must be measured in some other way. The method most utilized depends upon the fact that feebly damped circuits give much sharper tuning than those which are highly damped. In a later article this will be explained more fully, and various examples of tuning measurements will be given; for the present it will be sufficient to point out that the sharpness of tuning depends upon the amount of energy that may be accumulated in an oscillating circuit by resonance. Every wave of a wave-train adds its share to the energy being stored, hence it becomes almost obvious that the more waves there are in a train, the more energy will be stored. It is apparent from the pendulum experiments that the feebler the damping of an oscillating system, the more oscillations it will complete before it comes to rest. Since the waves in a wave-train correspond to the number of complete current oscillations in the antenna as a result of the spark generating that wave-train, it is seen that the less damped the antenna current, the more waves per train. Thus the less the damping, the sharper the tuning.

Fig. 5 is a curve which shows the number of complete oscillations in a wave-train of any normal decrement before the amplitude is reduced to ten per cent of its original value. By looking up the decrement along the horizontal line, then tracing upward until the curve is intersected directly over the assumed decrement value, and then following the horizontal line to the scale at the left, the various desired values may be found. Thus, for decrement 0.2 there are only 12 complete oscillations before the amplitude has fallen off nine-tenths, while for decrement 0.02 there are about 112 oscillations. As the decrement grows smaller the number of oscillations rises rapidly; for zero decrement the number would be infinite—the oscillations would be completely sustained and would not die away until the circuit was opened.

A National Wireless Association

THE National Amateur Wireless Association, headed by Guglielmo Marconi, inventor of wireless telegraphy, has entered the field of radio communication for the expressed purpose of promoting group, or co-operative, working among amateurs. The organization is a comprehensive one, aiming to direct and standardize radio experiment throughout the United States by arranging with each member for progressive courses of study and later through grouping the most promising radio enthusiasts with active co-workers and guiding the experiments along productive lines. The development of radio engineers from sincere investigators who are hampered by facilities for higher training is to be promoted by a series of specially designed experiments, supplemented by a monthly bulletin service.

Military wireless signaling is a branch of instruction to be given a prominent place in the program. Arrangements have been made for amateur clubs throughout the country to affiliate with military organizations as accredited members and officers of signal corps. This branch of training is under the direction of Major William H. Elliott, Adjutant-General of the Junior American Guard and one of the vice presidents of the Association. Several signal corps batallions have already been formed and are training to serve in the proposed third line of defense for the nation. Summer camps have been secured and field maneuvers will be featured in the vacation months.

From the New York headquarters of the Association, announcement is made that every amateur who is properly endorsed may secure membership as an individual. According to abilities and geographical location, members are entered for eligibility in some existing local club, state or inter-state association, and when these have secured recognition, a representative is appointed to the National Council with a voice in the management of the governing body.

In the unusual growth in popularity of wireless lies a possible source of benefit to the nation. Every skilled amateur could render great service to his country in time of war.

An Automatic Pressure-Gage Alarm

AN ordinary pressure-gage may be easily equipped with a simple home-made contact device, which will serve as an automatic alarm, giving the attendant an audible signal, when the pressure has exceeded or dropped be-

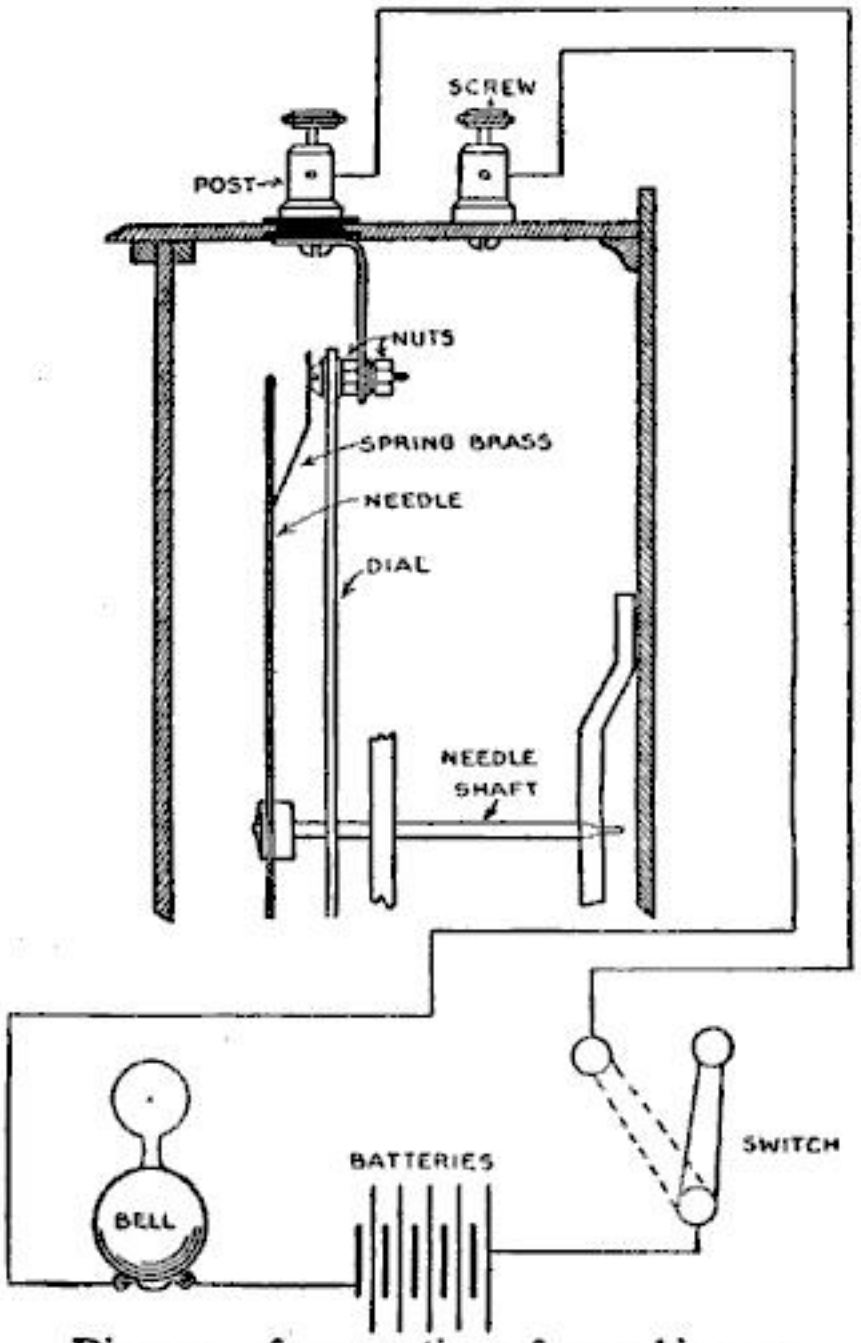


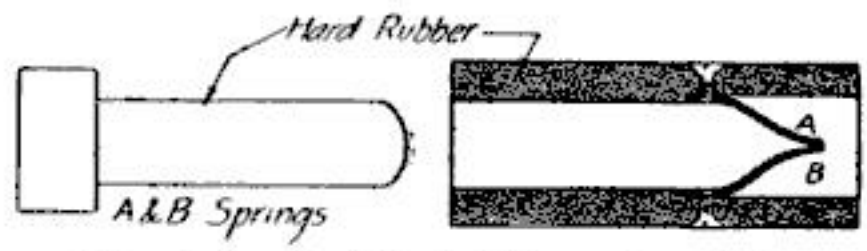
Diagram of connections for making an audible pressure-gage alarm

low a previously determined value. This device may be arranged as follows: Carefully remove the glass front of the gage and also the needle from its spindle. Then, on the under side and at the outer end of the pointed end of the needle, fasten a very light piece of spring brass, which is to brush over the contact to be mounted on the face of the dial. This contact is fastened on the face (of dial) in such a position that the spring on the end of the needle is in perfect contact with it, when the needle indicates a pressure corresponding to the value at which the alarm is to be given. It is, of course, to be insulated from the dial, and in turn, connected to a binding post, mounted on the outside of the frame, or containing case, of the pressure-gage and properly insulated from it. A second binding post is mounted on the case itself, and electrically connected with it. These two posts form the contact device, and are connected in series with the bell battery and a small single-pole switch. In remounting the needle on its shaft, great care must be exercised to see that it occupies the same position on the face of the dial that it did before. A little error may prove of great damage, in case it should indicate a pound or so less than is really the actual pressure. The spring of brass, on the outer end of the needle, should be very light and flexible, and so adjusted that it will move over the contact on the face of the dial with the minimum friction. It would, no doubt, be best to fasten a small piece of platinum on the points that touch or coincide with each other, to prevent trouble due to corrosion and arcing.

A diagrammatic sketch of the entire device, including the electrical connections, is presented herewith. One or more additional contacts may be mounted on the dial, at various spaces showing different pressures, etc. These contacts may also be put in circuit with bells, buzzers, and the like with different tones.—WM. WARNECKE, JR.

Fools Automobile Thieves

PROBABLY the simplest way to disappoint the automobile thief is by means of an inconspicuous lock which short-circuits the ignition system. Two springs should be installed in the walls of a rubber tube. When a rubber plug



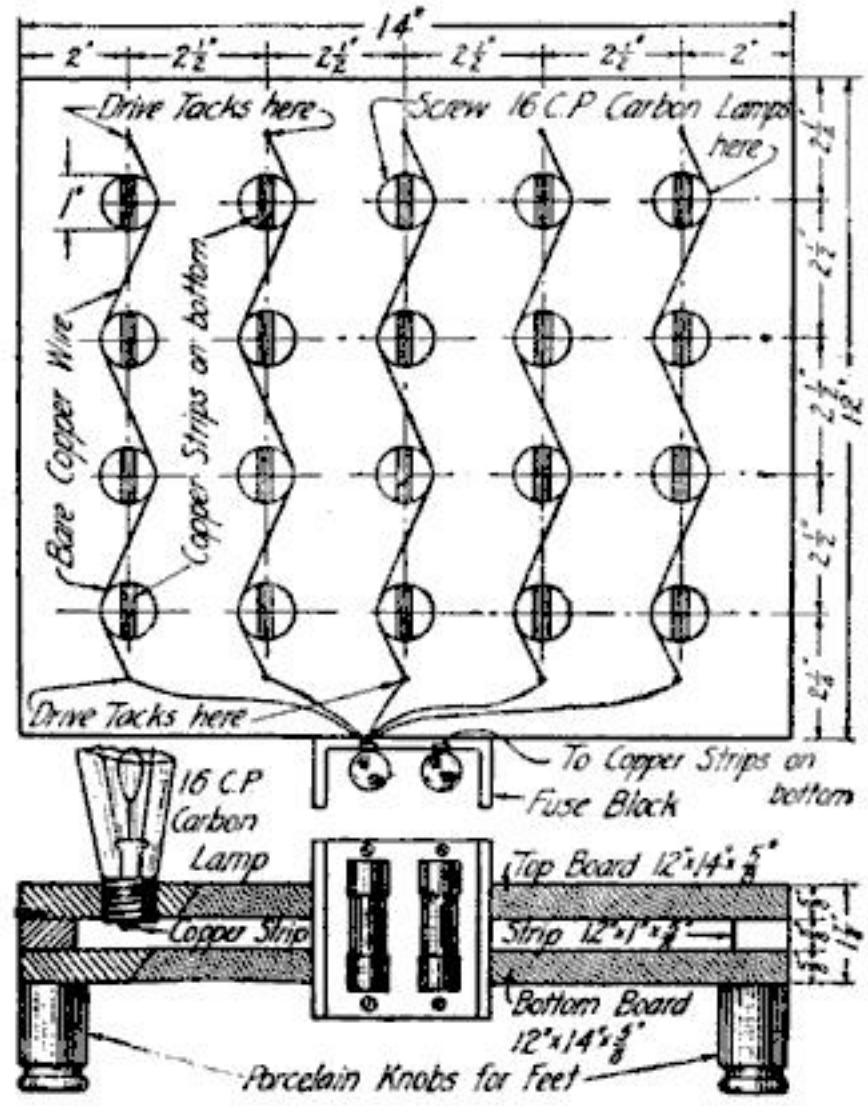
A short-circuit of the ignition system is the safest guard against automobile thieves

is inserted, the springs are forced apart and the current will go to the spark-plugs as usual. Withdrawing the plug allows the springs to come within sparking distance of each other, and the circuit is temporarily put out of order. One spring should be connected to the terminal of the magneto and the other to the automobile frame.

Lamp Resistance for Charging Storage Batteries

A LAMP bank resistance for reducing current in charging storage batteries, while wasteful of energy, is cheap in construction and is often useful in power houses or in those few places were electric current is abnormally cheap. The lamps are inserted in holes bored in a soft pine plank, making contact on the lower side with strips of copper or brass that are fastened by tacks. Contact with the other lamp terminals—the threaded bushings—is made by winding clean copper wire in a zigzag fashion between the lamps' bases, as indicated in the diagram. The wire should be wound about each lamp base several times to secure adequate contact, and soldered, if possible. A fuse block should be provided and the connections made as shown.

Old lamps are best, as their resistance is lower than new ones. If the polarity of the current is not known it can be found by placing one wire of the circuit in a tumblerful of water with a wire from the lamp bank opposite. Only a couple of lamps should be used in this test. By noting the bubbles that arise from the two wires, the polarity can be determined by marking the wire from which most bubbles rise. This is the negative side. Storage batteries will be ruined if the connections are not correctly made.



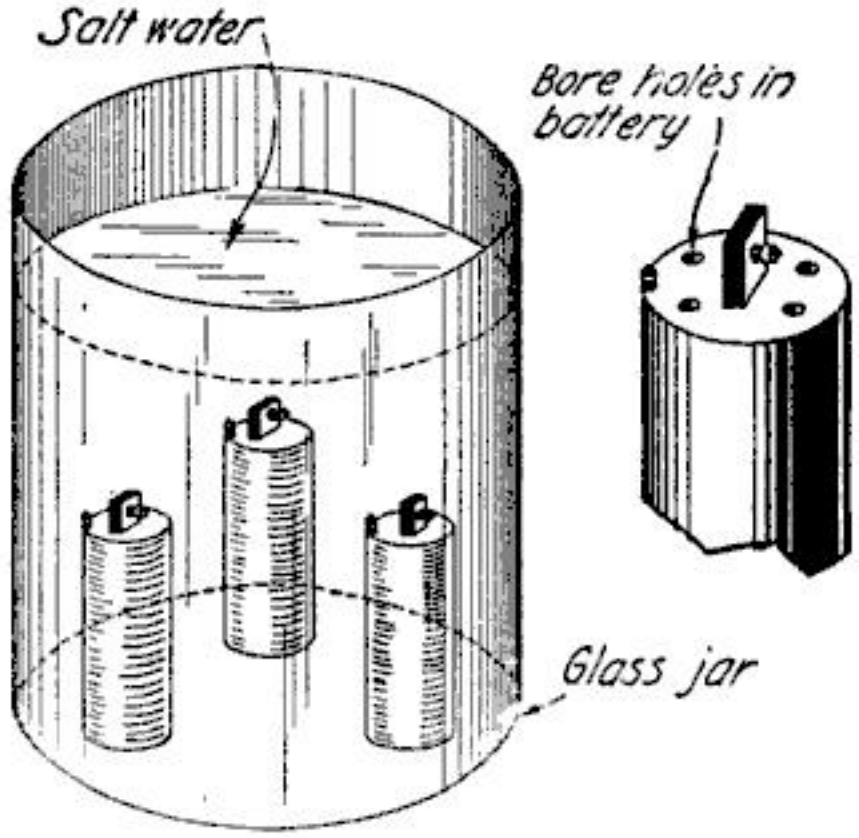
A simply arranged lamp bank for reducing voltage when charging storage batteries

Recharging Worn-out Dry Batteries

DRY batteries are made of dampened carbon cobalt. That all batteries have not the same life is due to the fact that they are dry from use, or leakage from evaporation through the top. Cheap batteries do not contain the quality of carbon found in high-grade batteries; hence it is useless to recharge cheap ones. A good high-grade battery will recharge three times before it is worthless.

Take six worn out batteries, drill four holes in the top of each through the tar covering (a red hot nail or a small drill will do), so that the black carbon can be seen. Fill a pail with water, so that it will be about one inch higher than the tops of the batteries. Dissolve three good handfuls of common table salt in the water. Do not use sal-ammoniac. Place the batteries in the pail in a standing position. Leave them for eight hours, stirring the salt water about twice during that time.

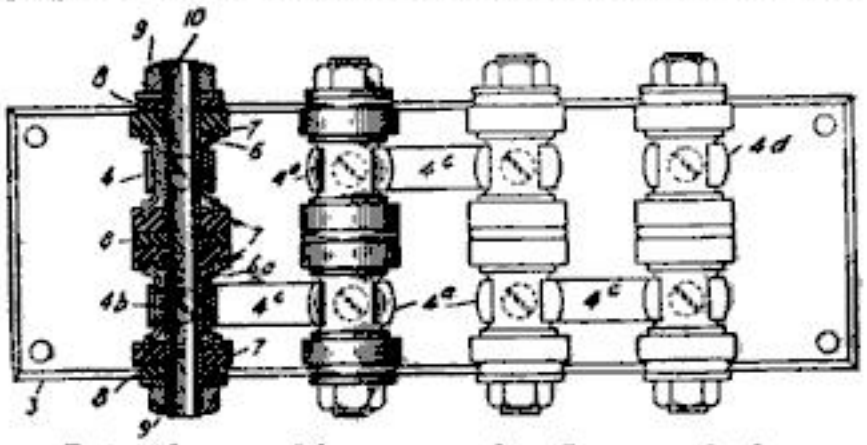
After removing the batteries, stand them upside down to let what water will run out (about two hours). Then seal them with a hot soldering iron; connect them, and they are ready for use. This can be done three times.—**T. F. Busch.**



Method of recharging dry batteries by immersing them in salt water

Tubular Quenched Gap

A PATENT for a novel form of quenched spark-gap is No. 1,132-589, issued in 1915 to F. H. Kröger. In the illustration is shown one of the diagrams forming part of this patent. The gap units are made up in groups of two sparking spaces connected in series, and each unit slips into a pair of clips much as does an ordinary cartridge fuse. This gives complete interchangeability and makes it possible to substitute new gaps for any which happen to break down,

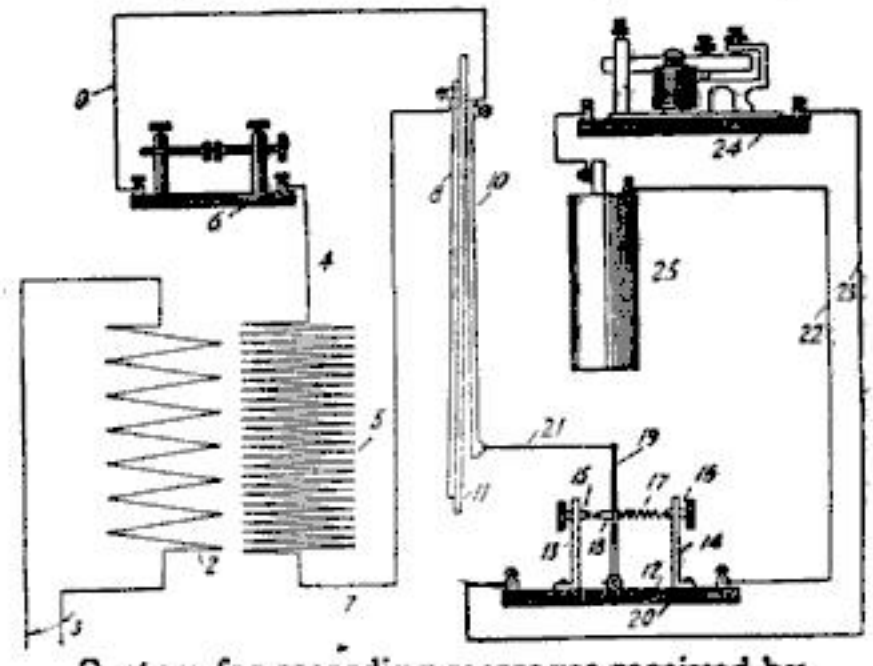


Interchangeable gap units for a tubular quenched gap

without disturbing the sections which remain in useful condition. As may be seen from the illustration, each unit has as its most important parts the central tube 10 and two shorter cylinders 6 and 6a, which slip over the inner tube with a small space between them and which have their ends expanded to a considerably larger diameter than their central portions. The outer tubes are supported by the grooved insulating disks 7, which serve also to hold them concentric with the inner cylinder 10. Between the end supports and at the extremes of the units are placed soft rubber washers 8, and the entire structure is clamped between washers and the nuts 9, so as to form a rigid, air-tight assembly. The spark passes between the inner cylindrical surface of the cylinder 6 and the upper, outer and parallel surface of 10, and, after the current traverses tube 10 to its lower portion, it passes from the lower outer surface of 10 to the inner and parallel surface of 6a. The current is then led to the second unit through clip 4c, and jumps two more gaps. As many gaps may be placed in series as needed. The spacing between sparking surfaces remains constant regardless of the pressure on the gaskets.

An Unusual Recording Receiver

IT has been known for many years that a wireless telegraph power transformer connected directly to lighting of power lines would often set up, in those supply circuits, very severe disturbances. Unless proper protective measures are resorted to, it sometimes happens that the operation of a wireless telegraph transmitter thus connected will cause sparking, insulation breakdowns and other troubles at some distance from the sending station. In a plan disclosed in U. S. patent No. 1,143,799, issued during 1915 to R. B. Avery, these line disturbances are made use of to record or make evident the operation of a wireless transmitter. Referring to the figure, it is seen that the primary 2 of a step-up transformer 1 is connected to the alternating current power lines 3. One terminal of the secondary coil 5 is led to the adjustable spark-gap 6 through wire 4, and the circuit passes thence through wire 9 to



System for recording messages received by power lines

the swinging plate of a special condenser, 10. The other plate of this instrument, 8, connects through 7 with the secondary coil and is separated from 10 by the insulating sheet 11. The pivoted sheet 10 is mechanically connected through 21 to the contact apparatus 12, which comprises a lever 19, moving and fixed contacts 18 and 15, and an adjusting spring 17, as shown. When this contact is closed, current flows from battery 25 through the local lines 22, 23, and the sounder or recorder 24 is operated.

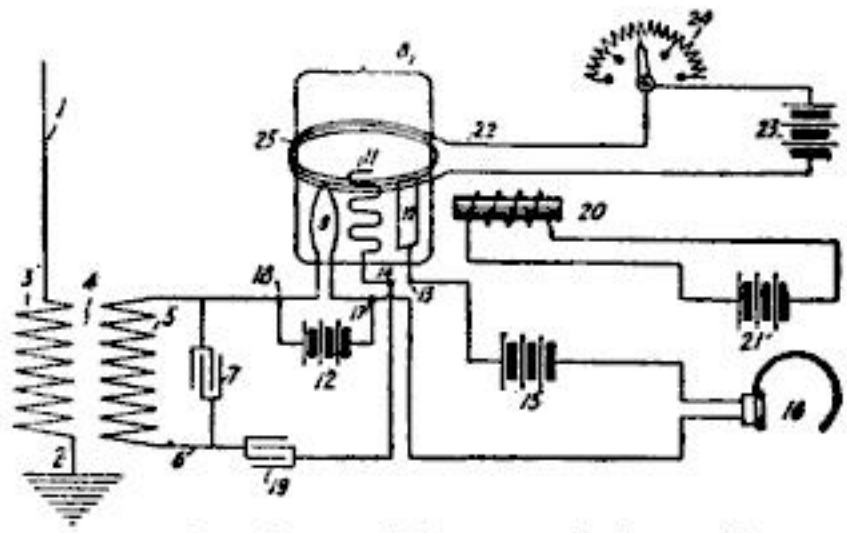
In using this receiver, the spark-gap 6 is opened just beyond the point where

sparks will pass from the normal operation of step-up transformer 1. When surges are set up in the lines 3 by the operation of the distant wireless transmitter, the impulses serve to increase the potential of the secondary 5 and a series of sparks passes across 6. This results in a stronger charge being placed upon condenser 8, 11, 10 and the plates are therefore attracted more strongly than before. By the ensuing motion of 21 and 19 the contacts 18 and 15 are brought together, the local current flows and the sounder or recorder is operated. As soon as the key of the sending station is opened, sparks cease to pass across 6, plate 10 swings back to its normal position, and the sounder circuit opens. Thus, it becomes possible to observe the transmission of wireless messages from a station in the vicinity without using an antenna or detector in the usual way. It is not always necessary for the instruments described to be connected with the power line supplying the wireless station, for often the inductive effects are sufficiently strong to operate such an apparatus located at a considerable distance from the signaling plant.

Magnetic Adjustment of Audion

A UNITED STATES patent issued in 1915 to B. Graves, No. 1,138,652, shows an interesting method of controlling electromagnetically the action of an audion receiver. The diagram of that patent is reproduced, in which the usual complete receiving-circuits are shown. The new features are the coil of wire 25 wound about the bulb and connected to battery 23 through regulating resistance 24, and the electromagnet 20, which is supplied with current from battery 21. By varying the position and strength of the magnet 20, and by altering the intensity and direction of current through the coil 25, the patentee has found it possible to increase the sensitiveness of his audions. The matter of magnetic control of such receivers is of considerable experimental interest, and it is doubtless well worth while to try this method.

The consensus of opinion on the matter, however, so far as there is any agreement, seems to be that any effects which can be produced magnetically may also be secured by variation of filament current, plate circuit potential and tube vacuum. Occasionally it is not found possible to get the best response from a given bulb by any of the ordinary adjustments, and in these instances full sensitiveness is sometimes secured by applying a properly-disposed



Increasing the sensitiveness of the audion with an electromagnet

magnetic field. The inventor of the method shown, states that by its use he has secured better results than from a simple magnetic field set up by a permanent magnet. It is probable that the independent control of magnet position and field intensity makes it possible to secure the best conditions more easily.

Learning the Code

AMATEURS learning the Continental code will find it a great help to practise sending and receiving words which necessitate the use of letters frequently misunderstood or forgotten. The prime essential in learning the code is to forget how each letter looks on the code chart and learn to recognize the letters by *sound*. Such letters as F, L, Y, Q, X, and others have a peculiar rhythmic sound which soon becomes familiar and easily recognized. The following words are helpful in code practice: fizz, fall, calf, fix, lax, liquor, lacquer, buzzer, squall.

Telephone Receivers

FOR long distance receiving, a good pair of head telephones is always a profitable investment. If the telephones are insensitive, it is useless to expect to hear distant stations.

An Electromagnetic Rectifier and a Polarized Relay

By R. E. Ryberg

The Rectifier

THE storage battery has become a necessity in the laboratory of the experimenter and wireless amateur. The problem then becomes one of supplying an efficient means of rectifying the alternating current in the house-lighting mains in order to charge these batteries. They could easily be charged

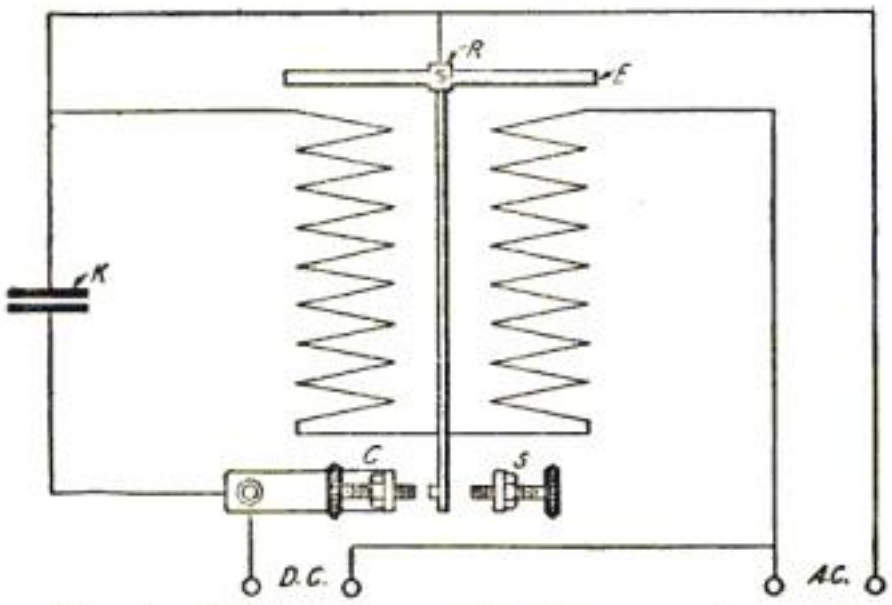


Fig. 1. Wiring diagram for large condenser

by a small direct-current generator, but not every experimenter has one at his disposal. Almost everyone has an electrolytic rectifier for this purpose, but this rectifier, besides wasting current, is a source of constant trouble and requires frequent cleaning. Therefore, the experimenter will welcome any device the operation of which will scarcely affect the meter.

Many experimenters have a polarized ringer about their shops, and this will answer very well. If the keeper or permanent magnet is weak it may require re-magnetizing.

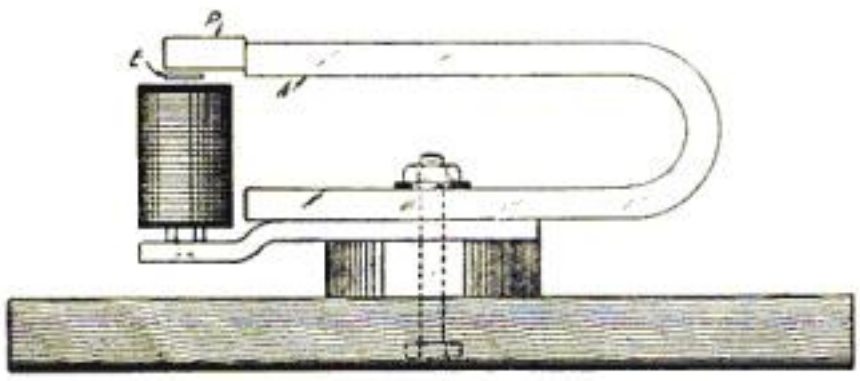


Fig. 2. Mounting of the polarized relay

The resistance of the coils is from 1,000 to 1,600 ohms, so it is readily seen that they will consume very little current,—about .06 ampere to .11 ampere on the 110 volt supply.

The clapper rod should be cut as short as possible, and bent outward to engage the permanent contact and stopper. The coils must now be mounted on a suitable hardwood base together with the stationary members, of which there are two, one being used as a contact and the other as a stopper. Platinum or silver contacts should be soldered to the permanent contact and the corresponding side of the clapper rod.

A condenser *K*, of large capacity, say ½ mfd. to 2 mfds. should be shunted across the contacts to reduce sparking. By adjusting the contact *C*, and the stopper *S*, Fig. 1, this device will work nicely. The wiring diagram is shown. In making the connection with the moving element, it should be soldered up on the clapper rod or the armature. Care must be taken to permit the clapper rod to swing freely. The connection should not be made on the armature support as the current should not pass through the bearing *R*. This arrangement uses one alternation of the cycle only; but the experimenter, by placing additional contacts, may take advantage of the complete cycle.

The Polarized Relay

The same instrument can be used as a polarized relay with only a few changes.

A polarized relay is a most useful instrument for the experimenter. It is the only relay that can be used in multiplex telegraphy and the best relay to use in conjunction with selenium cells and coherers. The reader will realize a few of its many uses. The instrument shown in the illustration, when used as a relay, will operate successfully on .5 milliampere.

One of the changes mentioned was the use of a powerful magneto magnet in place of the keeper or permanent magnet which is ordinarily used. The method of mounting is shown schematically in Fig. 2. In using the magnet it must be mounted so that the lower surface *A* of the upper pole is above or level with the top of the armature *E*, so that the lines of force will penetrate the armature. A pole piece *P* can be used to extend the pole of the magnet. If used, it must be located over the center of the armature. It can be about ½″ square by ¾″ long. Its use can be determined by trial, since it does not always improve the operation of the instrument.

The magneto magnet can be obtained second hand for about 50 cents at a motor-cycle repair shop or a garage. If weak it can be re-magnetized for almost nothing. For a polarized relay of over 1,000 ohms resistance a few cents spent in obtaining a powerful permanent magnet will be an excellent investment, as the commercial instrument of this resistance is beyond the means of the average experimenter.

When used as a relay, it is unnecessary for the clapper rod to swing very far, so that the armature *E* may be lowered to close proximity with the ends of the magnet cores by means of two adjusting nuts. The distance can easily be determined by experiment. When used as a rectifier this distance need not be as small and can be adjusted accordingly. The bearing-screw *R*, Fig. 1, should be adjusted to prevent any undue play of the armature, but on the other hand, it must not be made tight enough to bind.

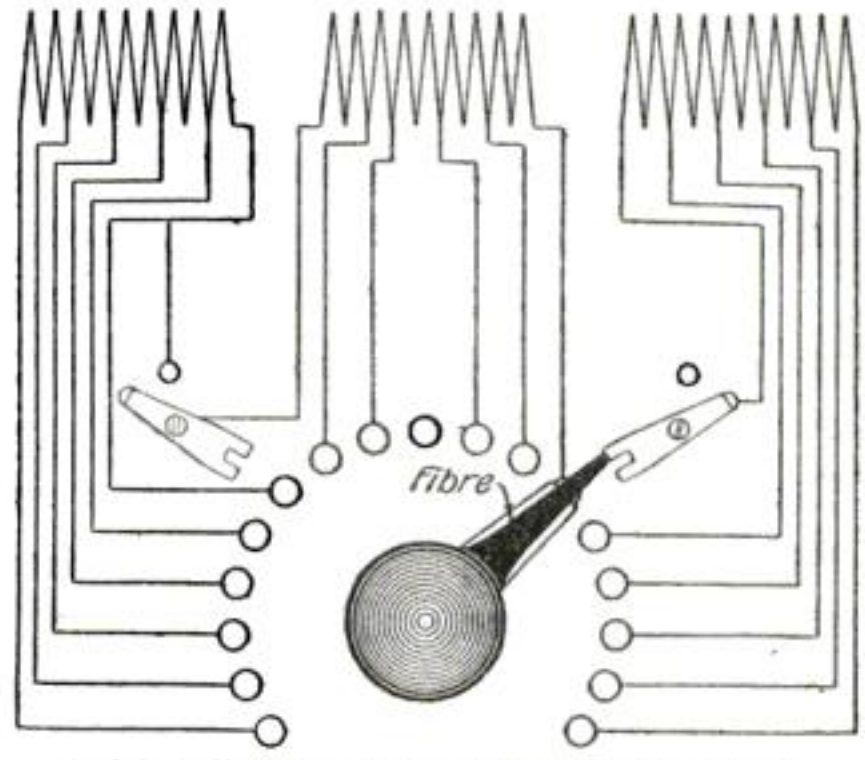
Inexpensive Stranded Aerial Wire

T is a well-known fact that stranded wire is preferred for aerials to solid wire, but it is not used much by amateurs since the cost is high. An inexpensive stranded wire may be made, however, as follows:

Find the length of aerial wire needed and then cut five pieces of No. 20 bare copper wire that length. Lay them together and about every two feet twist the strands twice. The resulting wire is of low resistance, high tensile strength and proves very satisfactory.

Automatic Dead-End Switch

THE multiple-point switch, shown in the illustration, is equipped with small auxiliary switches to cut off the wire not in use on loose-coupler primaries or loading-coils. Most dead-end switches must be opened or closed independently, but this one is operated by the movement of the multiple-point switch itself. It cuts off the primary in steps, immediately after you cut in less coil than the amount where each break occurs. Thus no switches are forgotten. The diagram explains its construction, and dimensions are not given, since they will vary somewhat, according to the specific needs of the maker.



Wiring diagram of a multiple-point switch

Avoiding Grounding in Running Metal Molding from Chandelier Outlets

TO run metal molding from outlets from which chandeliers are hung, and avoid grounding, the following method is suggested. Cut away the canopy as shown in Figure 2, and apply insulation between the canopy and separable, metal outlet box. This produces a neat appearance and is inexpensive.—JOSEPH FISHER.

Fig. 1. Fig.2.

Money Prizes for Radio Articles

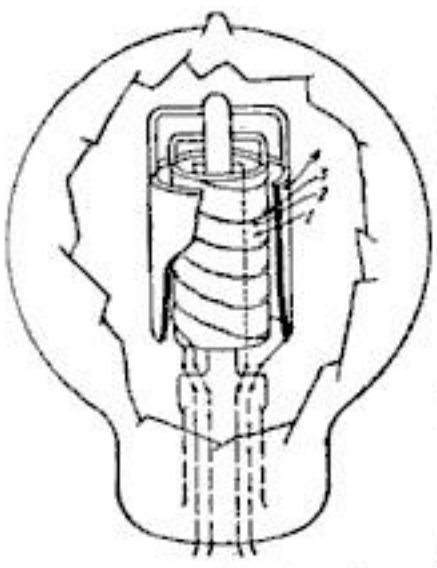
We want you to tell our readers how you have overcome your wireless troubles. Every radio operator, amateur or professional, has encountered difficulties in building or using his apparatus. Many different people are bothered by the very same problems day after day. It will help you to learn how others worked to get successful results, and it will help others to learn how you succeeded.

For the two best articles describing how you overcame troubles in building, operating, adjusting or repairing any radio instrument or group of instruments, we offer first and second prizes of **$25.00** *and* **$15.00** *respectively. The prizes will be awarded to the two writers whose articles, in the opinion of the Editors, will prove most helpful to the readers of the magazine. The Judges of the Contest, who will be the Editors of the* POPULAR SCIENCE MONTHLY, *will select the prize-winning manuscripts from those which conform with the following conditions:*

CONDITIONS OF PRIZE CONTEST

1. *Manuscripts must be typewritten, and on one side of the paper only.*
2. *Illustrations must be on sheets separate from the manuscripts.*
3. *Articles must be addressed to the Radio Prize Contest,* POPULAR SCIENCE MONTHLY, 239 *Fourth Avenue, New York, and must reach that address before June* 15, 1916, *in order to be considered.*
4. *Manuscripts which do not win prizes may be purchased for publication, at the option of the Editors and at the usual liberal rates.*
5. *The decision of the Judges, which will be announced in the August,* 1916, *issue, is to be final.*
6. *Each manuscript must be accompanied by a letter containing criticisms and suggestions as to the wireless section of the* POPULAR SCIENCE MONTHLY. *The merit of these letters will not be considered in awarding the prizes, but their suggestions will be taken as indications of what types of articles are of the most value to our readers.*
7. *If contestants wish to have their manuscripts returned, they should send postage for that purpose.*
8. *Articles should not exceed* 2,000 *words in length. If you cannot present your information in an article of that length, write several articles, each on a different phase of the subject, and each independent.*

Audion of Increased Sensitiveness



New Audion Bulb

IN the attempts to increase the sensitiveness of audion detectors and amplifiers, there have been devised many internal arrangements of the three usual elements (grid, plate and filament). In some, the spacing of the conductors is changed, and in others the forms of the electrode are radically different from those usually encountered. A type of tube shown in the diagram, was patented by A. McL. Nicolson in 1915. It is illustrated in the diagram accompanying specification No. 1,130,009. This instrument contains within its evacuated bulb two concentric cylindrical electrodes, of which the inner 1 corresponds to the grid and the outer 4, to the plate of the ordinary audion. The filament 2 is wound spirally around the inner electrode in a groove 3, but is, of course, insulated from the surface supporting it. The construction shown is said to show increased efficiency because the filament is placed close to the input electrode 1 and because this electrode is of large surface; these two conditions co-operate to set up a strong electrostatic field between the filament and the grid or its equivalent, and this has been found to make for increased amplification.

Constructing a Variable Condenser

A VARIABLE condenser, cheap and easily made, requires the following materials: tinfoil, 2 ft. of ¼-in. ash or oak, and 9 plates of glass, such as old photographic negatives. The plates should be 3¼ ins. by 4¼ ins.

Cut 18 rectangles, 3¾ ins. by 2¾ ins., of tinfoil. Shellac them at the center of both sides of the glass plates. Care must be taken that the foil forms an even coating on the glass. Next, construct a box of 5 sides, having the following dimensions:

Top . . . . . 4⅝ ins. by 2½ ins.
Bottom . . . . . 8½ ins. by 2½ ins.
Sides . . . . . 4¼ ins. by 3 ins.
Back . . . . . 2¼ ins. by 3 ins.

Before assembling the box, make 9 cuts lengthwise across the top and bottom, 3/16 in. apart and ⅛ in. deep. The first groove on the top and also on the bottom should be made ½ in. from the edge. These grooves will be the correct width to hold the plates firmly in place, if made with a rip-saw. The 2nd, 4th, 6th and 8th grooves from either side must be somewhat wider than the others so as to allow the plates to slide along easily. The top and bottom of the box are glued and nailed to the sides, as shown in Fig. 1.

The back is put on after clips have been fastened to the 1st, 3rd, 5th, 7th and 9th plates and a wire soldered across them, as shown in Fig. 2. The

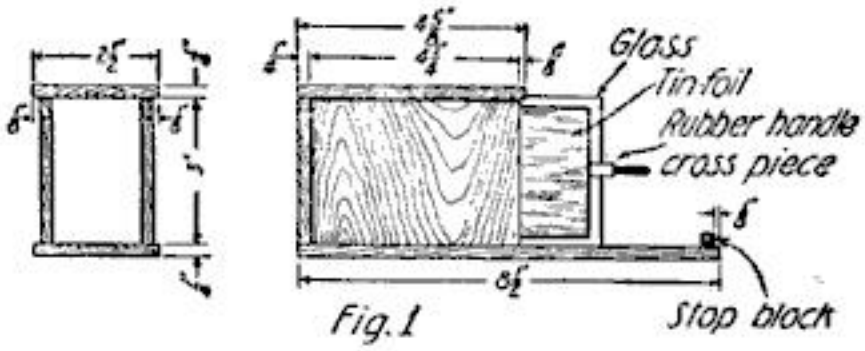


Fig. 1

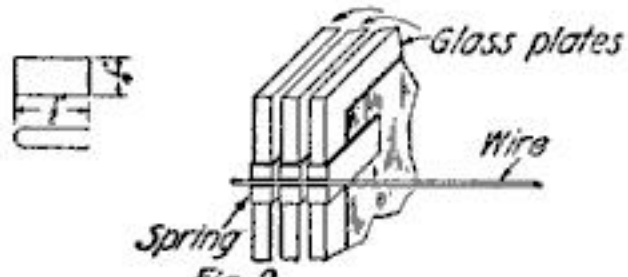


Fig. 2

Fig. 3

A variable condenser can be made with old photographic plates and tinfoil. These diagrams show construction details and the necessary connections

second, 4th, 6th and 8th plates are also to be connected together in the same way.

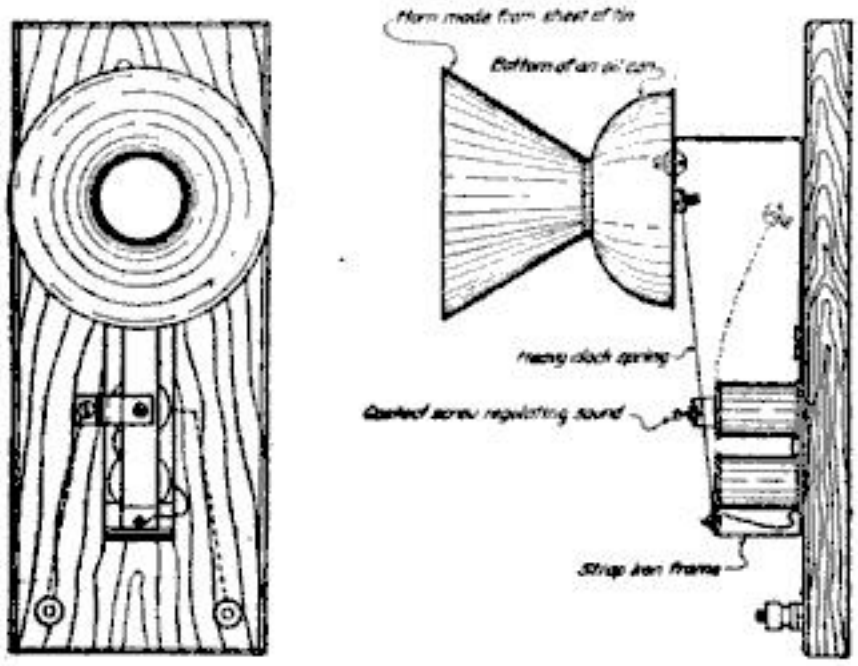
A wooden stop-block, measuring ¼ in. by ½ in. by 2 ins., must now be made and fastened ⅛ in. from the edge of the end of the bottom, as shown in Fig. 1. A handle of hard rubber should be fastened to a cross-piece, measuring ¼ in. by ½ in. by 2 ins., and having 4 grooves like the ones first made, but ⅜ in. apart. The first should be 7/16 in. from the end.

The terminals should be made of spring-brass less than 1/32 in. thick and bent as shown in Fig. 3. One touches the tinfoil of the first plate: the other touches the foil of the eight plate, as shown.—W. E. FINKERNAGEL.

How to Make an Electric Horn

ANYBODY having a little mechanical ability can make a very satisfactory electric horn from a couple of coils and a few odds and ends.

In the accompanying diagram, the electromagnets and horn are fastened to a continuous piece of band iron, which in turn is screwed to a wooden base. On the end of the band iron over the electromagnets is fastened a piece of heavy clock-spring. This serves as a vibrator or armature. At the free end of the spring a hole is drilled, through which is screwed a heavy stove bolt, which acts as a striker. A small strip of strap iron is screwed into the base, bent over the vibrator, and drilled to hold a 'set-screw, which is merely a small bolt with a nut on both sides of the iron. This is the interrupter. It also controls the pitch of the horn.



A practical electric horn which was made from odds and ends

The mouth of the horn is cut from a piece of tin and soldered to the bottom part of an old machine-oil can, the flexible base acting as a diaphragm when set in vibration by the striker.

The electricity runs through this horn in exactly the same circuit as in a door-bell. When connected up and the button is pressed, the vibrator is drawn to the coils and the circuit broken by the interrupter, causing the striker to move back and forth. The less room given for movement by the interrupter, the higher the pitch of the horn.

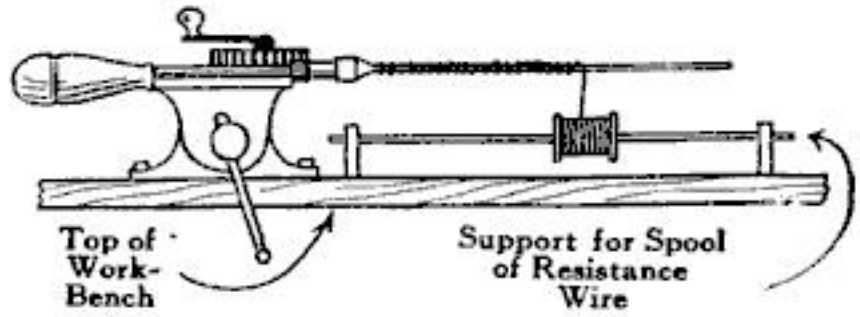
The vibrator, being made from a spring, lends still more force to the vibrations.

This horn may be worked on the house-lighting circuit by connecting in series with an incandescent light, or it may be run by batteries.

It can be used for many purposes, being especially good for a burglar alarm.—ED. GETTINS.

Making Coils of Resistance Wire for a Small Electric Stove

RESISTANCE wire may be easily wound in coils for a small electric stove by means of a hand drill. Place



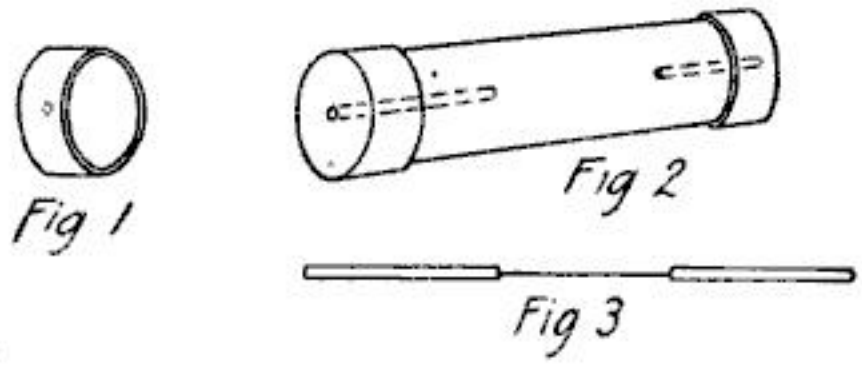
Resistance coils can be wound evenly by means of a hand drill fastened securely in a vise during winding

the drill in a horizontal position between the jaws of a small vise. Insert a rod of about ⅛-in. diameter in the chuck of the drill; an old curtain rod will do. Make a support for the spool, as shown in the illustration. Then, by turning the handle of the drill with the left hand and guiding the wire with the right hand, the wire will come off very easily without becoming tangled.

With about 18 ft. of No. 30 nichrome wire, a small electric stove will consume practically 100 watts of electrical energy.—FRANK HIEMER, JR.

Repairing a Burnt-Out Fuse

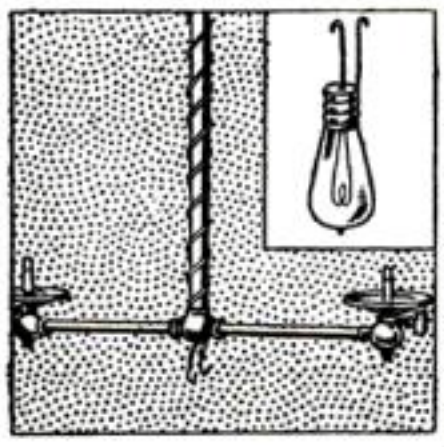
A BURNT-OUT fuse may be easily repaired with the aid of a little solder. Substitute for the old fuse wire a new one of the same capacity. Solder a length of copper wire to each end of the fuse wire (Fig. 3), and after cleaning



A burnt-out fuse can be made as good as new at very small cost

the brass ferrules around the hole (Fig. 1), apply a small amount of solder to each. Assemble the fuse by slipping the copper wire through the hole; then apply solder and mend with a hot iron. Fit the fuse in the fiber and in the hole in the opposite brass ferrule. Tin in the same way as before and cut the copper wires flush with the brass end, as in Fig. 2. The fuse will then be found to be as serviceable as before.

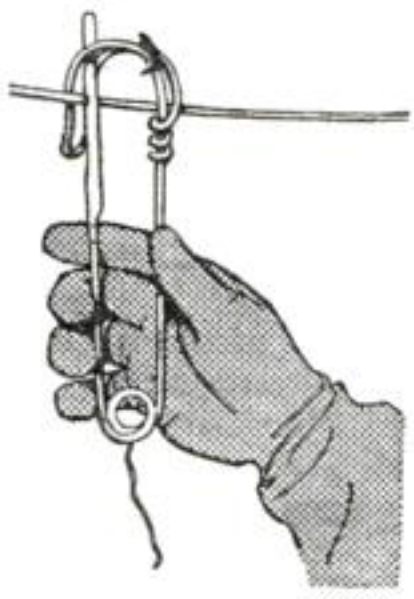
Substituting a Flashlight for a Door-Bell



WHEN there is sickness in the house, it is often necessary to avoid all noise as far as possible. At such times the door-bell is a source of great annoyance. To overcome this difficulty, disconnect the wires from the bell and run them down the gas or electric fixtures. Leave the ends bare and bend them into hooks, as shown in the diagram. Secure a flash-light bulb and solder two wires to it, bent as shown. The flashlight can then be connected with the push-button at the door by simply hooking it on to the wires.

This arrangement is also of great service to anyone who is deaf. If wires are arranged in every room, the flash-light can be attached in whichever room the deaf person happens to be. Thus a bell is not needed.—J. E. NOBLE.

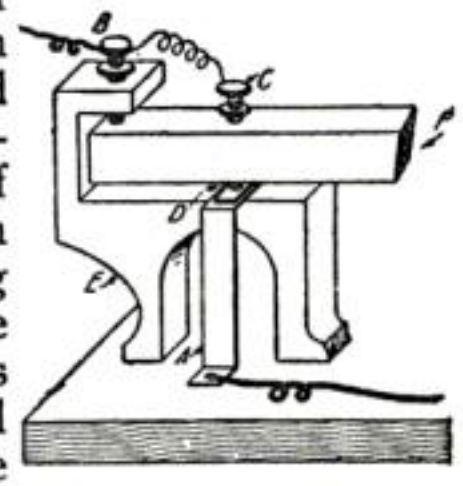
Telephone-Line Test-Clips Easily Made



ANY telephone man can make a pair of line test-clips for ten cents. Buy two large safety-pins and cut ¼ in. off the point of each. Solder a piece of No. 6 copper wire, 1½ ins. long to the part from which the point was cut so that it will pass between the wires at the open end of the pin.

File a small groove in the copper in which the line wire may rest. Then simply solder the test cord to the loop at the other end of the pin.

Changing a Telegraph Sounder Into a Relay



A TELEGRAPH sounder can easily be changed into a relay by adding a small piece of copper as shown in the accompanying diagram. A piece of sheet copper is bent as shown and placed under the screw *C*, but previous to this, a piece of thin mica is placed between screw *C* and stand *E* at *D*. A piece of small wire is coiled and carried from the screw *B* to the screw *C*, to insure a good contact.

The two telegraph wires are attached to the regular binding posts and the relay wires are connected with screw *B* and copper *A*. When the magnet's base is drawn down, the arm *F* completes the circuit in *B* and *A*.—WM. HARRIER.

A Current Reverser for Small Motors

A DOUBLE-POLE, double-throw switch, if connected according to the accompanying diagram, will reverse the direction of a direct-current motor. Disconnect the wires on the motor that are connected to the binding posts, brushes and field. Connect binding post No. 1 of the switch and No. 6 post to one end of the field. Connect the other field terminal to posts No. 2. and No. 5. One brush is connected to one binding post of the motor and No. 3 post of the switch. The other brush is connected to No. 4 post. The batteries are inserted between one of the binding posts on the motor and No. 3 post of the switch.

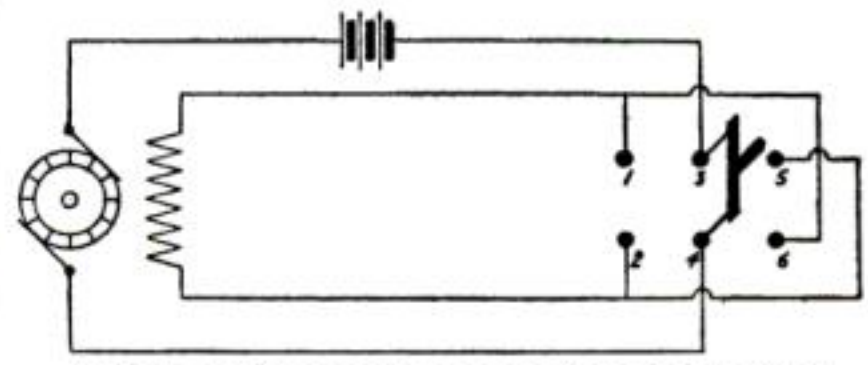


Diagram of current reverser for small motors

What Radio Readers Want to Know

Receiving Tuner; Sending Condenser

L. J. T., St. Louis, Mo., inquires:

Q. 1. Some confusion exists in my mind regarding the designs for receiving tuners. Take for example the following: For a receiving tuner to be adjustable to wavelengths from 175 to 4,000 meters, is it preferable to construct two separate tuners or may two small-sized tuners be joined together (in the primary and secondary windings) to receive the longer wavelengths? Also, what is the most desirable size for the cylinder and the size of the wire in the primary and secondary? Is single cotton-covered wire better than enamel wire? In addition, approximately how many taps are required on the secondary winding?

A. 1. A receiving tuner of this range is practical provided the precaution is taken to fit it with dead-end eliminating switches. If the dead-end losses are to be wholly eliminated, you are advised to construct two separate tuners. Assuming that the smaller tuner is to be used for amateur work it may have the following dimensions: The primary winding is 3½ ins. in diameter by 2 ins. in length covered with from 80 to 85 turns of No. 28 D.S.C. wire. The secondary winding is 3 ins. in diameter by 2 ins. in length covered with No. 30 D.S.C. wire. The secondary winding is equally divided between the taps of a three-point switch, while the primary winding may be fitted with a slider. Connected to an aerial of the dimensions found at the usual amateur station, the following described receiving tuner will permit adjustments in both the antenna and detector circuits to a wavelength of 4,000 meters. The primary winding is 4 ins. outside diameter by 7 ins. in length and is wound closely with No. 24 S.S.C. wire. The secondary winding is 3½ ins. in diameter by 6 ins. in length wound closely with No. 30 S.S.C. wire. The turns of the latter winding should be equally divided between the points of a ten-point switch. The primary windings may be fitted with a slider or preferably two 10-point switches, one of which takes in a single turn at a time and the second one connects in a number of turns in groups.

The secondary winding must be shunted by a condenser of small capacity; one of .0005 microfarad capacity will permit the reception of wavelengths in the vicinity of 4,000 meters.

If you are familiar with the construction of dead-end switches the windings of the long wavelength tuner may in this manner be broken up into groups and a small portion used for the reception of amateur signals, though the efficiency will probably not be so high as when two different tuners are used.

Q. 2. Please give the dimensions for a condenser to be connected to a 1-k.w. transformer regardless of the 200-meter wave.

A. 2. The proper capacity of the condenser depends upon the secondary voltage of the transformer and the frequency in cycles per second. Lacking this data we can not advise. If the potential of the transformer is 20,000 volts at a frequency of 60 cycles, it is customary to fit it with a condenser having a capacity varying from 0.012 mfd. to 0.018 mfd. A single plate of glass ⅛ in. in thickness with other dimensions 14 ins. by 14 ins. covered with foil 12 ins. by 12 ins. will have a capacity of 0.002 mfd. Nine of these plates, connected in parallel, will total 0.018 mfd. If as assumed, the potential of the transformer is 20,000 volts, a series-parallel connection for the plates is required, that is to say, 18 of these plates must be connected in parallel in each bank and the two banks connected in series.

The Use of Loading-Coils

E. C. T., Beaumont, Texas, inquires:

Q. 1. Approximately what is the wavelength adjustment possible with a double-slide tuning-coil 18 ins. in length, 3 ½ ins. in diameter, wound with No. 22 S.C.C. wire?

A. 1. Connected to the average amateur aerial this coil should permit adjustments to stations employing wavelengths as great as 3000 or 3,500 meters.

Q. 2. Would I secure better results if the coil were wound with bare wire?

A. 2. Not necessarily, since either bare or insulated wire may be employed. This coil is too large for the maximum degree of efficiency at wavelengths lying between 200 and 1,000 meters. For the ordinary aerial a single coil of wire, 6 ins. in length by 3 ins. in diameter wound with No. 26 S.S.C. wire, will be sufficient for the lower value of wavelength.

Q. 3. Will a pancake loading-coil increase the wavelength of the above tuning-coil?

A. 3. Yes, but we see no need for it.

Q. 4. How is the loading-coil to be connected to the tuning-coil?

A. 4. It should be connected in series with sliding-contact connected to the aerial wires.

Ground Connection

P. V. D., Warwick, N. D., inquires:

Q. What form of earth connection is considered desirable where the sub-soil consists of hard and very dry clay?

A. If by digging to a depth of several feet moist earth cannot be reached, you are advised to install what is known as a "surface ground." For your purposes this artificial earth connection may consist of several long copper wires spread out radially from the base of the mast and the greater portion placed directly underneath the flat top portion of the aerial. There should be at least as much wire in this "ground" as there is in your antenna.

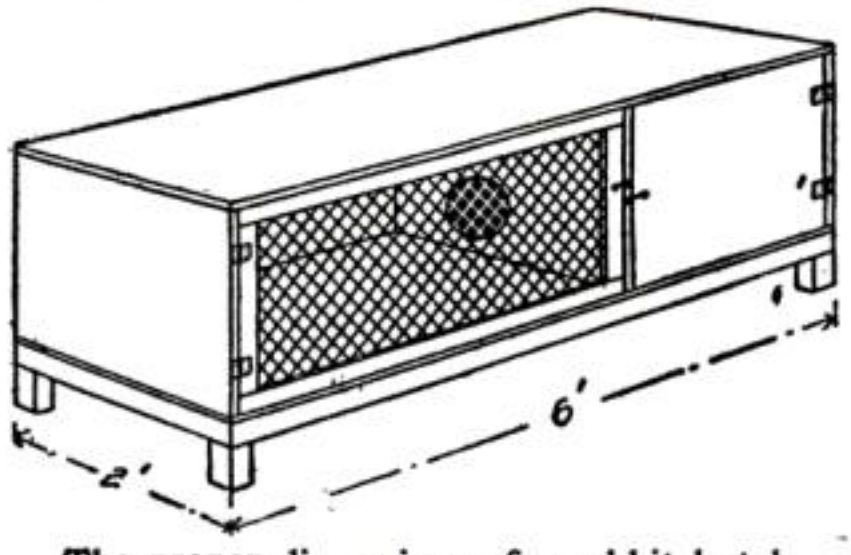
The Home Workbench

How to Build a Rabbit Hutch

RAISING rabbits near a large community is a profitable industry, and it is an enterprise that many schoolboys in America have embarked upon, with returns in money that are indeed out of proportion to the small amount of time and energy necessary for the proper care of the little animals.

The construction of clean, comfortable homes for rabbits, as recommended by the Department of Agriculture, is as follows:

The hutches, as they are called, should be built of good, sound lumber, and should have tight floors, providing at least 12 sq. ft. of floor space. The best plan for building hutches in quantity is that used in building sectional bookcases. The bottom section has short, stout legs, while the others are placed upon it until the desired height is reached. A convenient size for an outdoor hutch is one measuring 6 ft. in length, 1½ ft. in height, and 2 ft. in



The proper dimensions of a rabbit hutch are six by two by one and a half feet

width. The top, bottom, ends and one side should be enclosed, while the open side is fitted with two doors on hinges. The space should be partitioned, so that one-third comprises the sleeping quarters, while the remaining two-thirds serve as exercising space. A hole, large enough to admit the passage of a full-grown rabbit's body, is cut in the partition. Of the two doors which enclose the two rooms of the "apartment," one is of

A portable hutch, with two stories, which can be carried about by two boys

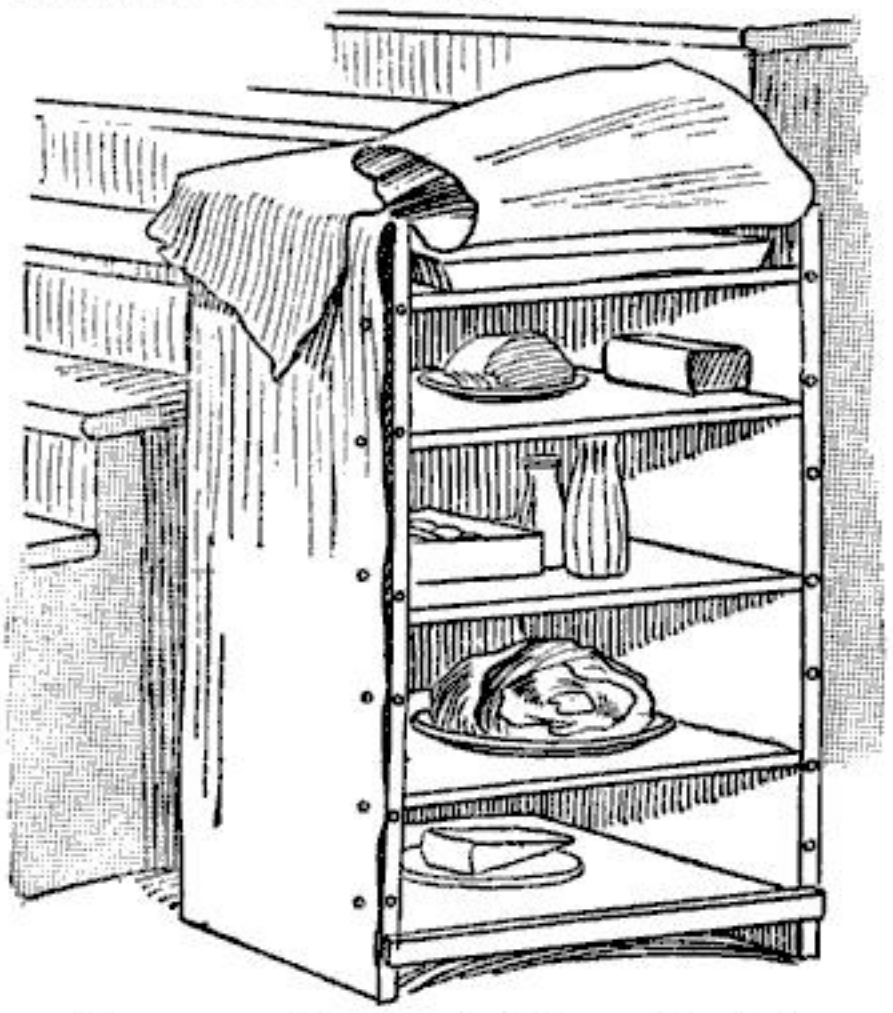
wood, and the other of wire mesh similar to that used in enclosing poultry runways. The screen door should be provided with a sliding wood cover, as a protection against severe cold weather.

Outdoor hutches, which are desirable for most of the climates found in America, are best, and should be fitted with sloping roofs and made otherwise watertight. Holes for ventilation should be bored in the side walls near the ceiling. Several layers of waterproof paint should be applied.

Rabbits thrive on a diversity of vegetable foods. The most important fact to bear in mind in feeding is that a sudden change of diet is often disastrous. The best grain for rabbits is oats, although this dietary monotony

may be broken occasionally by cornmeal, barley, or other grain. Hay is necessary to the rabbit's health. During the winter, green foods are required together with grain. Two meals a day, except for suckling stock, when three should be given, is the best schedule.

The Belgian hare is ready for the market at the age of four months, although some breeders sell at the age of ten to twelve weeks, aiming to have their stock weigh about five and one-half pounds at that age.



The pan on the top shelf keeps the duck curtain wet and the evaporation of the water cools the whole box

How to Make an Iceless Cooler

ON farms where ice is scarce, the device illustrated is of great utility. It consists of a box of convenient size, with shelves at various distances apart. In the drawing, the upper shelf is about 3 ins. from the top of the box, which is about 12 ins. by 18 ins. square. The bottom shelf is 13 ins. above the floor, the second shelf 12 ins. above that, the third 11 ins. higher, and so on. A pan of water is placed on the top shelf.

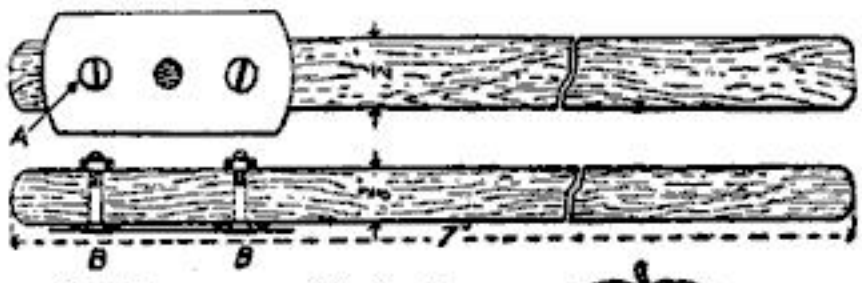
The box should be placed where there is more or less movement of air, to encourage an evaporation of the water which keeps a heavy duck curtain wet all the time. This curtain completely envelops the box. It is tacked on two sides and on the back, but left loose in the front. Only two lengths need be used, one starting near the floor on one side, extending loosely over the box and down on the other side; the other extending from the floor behind to the top and fastening at the sides, but left loose above and down at the front. The front should have buttonholes to go over pegs at the side.

When the pan is filled with water, the duck should rest in it, so that the water will flow by capillary attraction to the floor. Very little of it should actually reach the floor, because most of it should be evaporated by the air. This method will actually keep the temperature inside the box considerably cooler than that outside. This cooler is easily made and the cost is reduced to a minimum.—Dr. L. K. Hirshberg.

A Vegetable Peeler Made from a Razor Blade

AN old safety-razor blade can be used for peeling vegetables, by attaching it to a wooden handle, as shown in the illustration. The handle should be 7 ins. by ⅜ in. by ½ in., and should be sandpapered to a smooth finish. Attach the blade by means of two bolts *A*, ⅛ in. by ½ in., having flat heads. Place a washer *B* on each bolt, between the blade and handle.

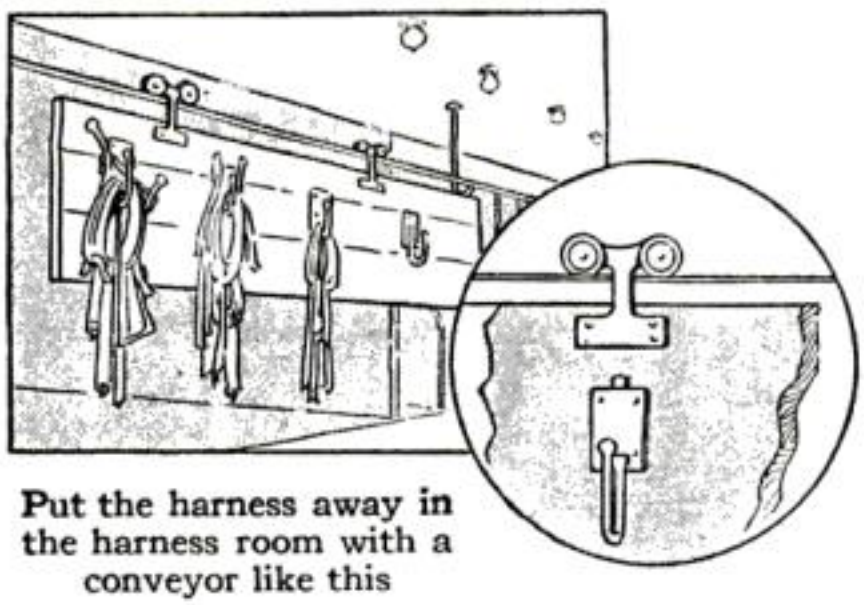
If a drill is at hand, a strip of iron or brass may be substituted for the wooden handle. Many uses can be found for this handy knife.—J. E. Noble.



If the razor blade is properly adjusted the fruit may be peeled quickly and without useless waste

Soldering German Silver

GERMAN silver cannot be soldered with lead without showing a difference in color. The following formula obviates this difficulty: Silver, 1 part; brass, 1 part; zinc, 1 part. Melt in the ladle, stir, pour into the mold and cool. The flux for the foregoing is borax powder.—T. F. Busch.



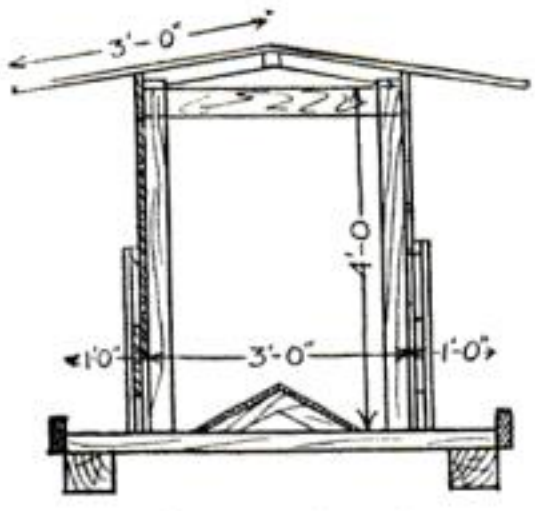
Put the harness away in the harness room with a conveyor like this

A Harness Carrier

FARMERS generally have difficulty in keeping their harness in repair and in the proper place. Hanging it up on an old hook about the stable is not in accordance with present day efficiency methods. On a certain Iowa farm a noteworthy system of caring for the harnesses is practiced. The harness carrier runs over the litter carrier track of the barn and into the harness room near the stable. The carrier is made of three planks cleated together with boards. There are four hooks on each side of the carrier for hanging the heavy work harnesses. The litter carrier track runs behind all the horses, so the only additional track that is needed, is that which runs into the harness room.

An Ear-Corn Feeder for Hogs

A SELF-FEEDER for hogs, which will hold approximately 20 bushels of ear-corn, is easily made. The crib has a base 3′ by 4′ and is 4′ high. It is built on a solid frame of 2″ lumber and covered with 6″ crib siding for the walls, and ship-lap for the roof. The siding should be spaced 1″ apart for ventilation. Surrounding the base is a trough 1′ wide with a fender on its outer edge made of lumber 2″ by 4″.



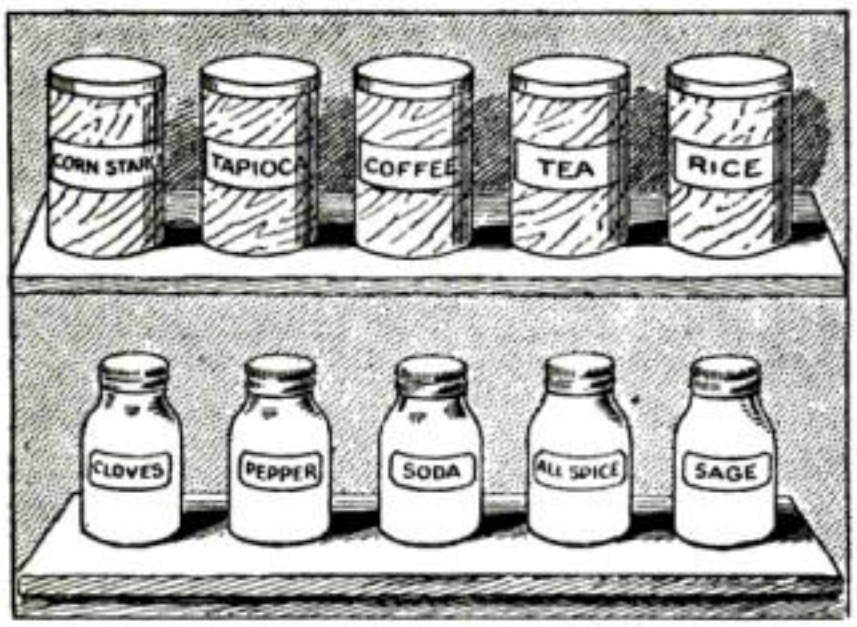
The corn is deflected into the trough by a pyramidal arrangement in the crib, as shown in the cut. Its flow is further regulated by an adjustable slide held in place by bolts with winged nuts. The trough is sheltered somewhat by the overhanging roof, made from boards 3′ long. One section of the roof should be hinged for filling. The feeder should be built on skids or runners so that it may be hauled about the lots to any desired location. It may be painted and set in a high, well-drained spot or on a concrete platform. The lumber list follows:

2	pcs. 4″ x 4″ x 7′ runners
6	pcs. 2″ x 10″ x 5′ floors
2	pcs. 2″ x 4″ x 6′ trough-fender, sides
2	pcs. 2″ x 4″ x 5′ trough-fender, ends
6	pcs. 2″ x 4″ x 4′ studding
4	pcs. 2″ x 4″ x 6′ plates
50′	ship-lap for cover, 3′ lengths
50′	(lin.) 1″ x 4″ cleats
80′	1″ x 6″ crib siding
30′	1″ x 12″ slide
2	12″ strap-hinges
10	bolts, with winged nuts

The hogs can get at the trough but not into the interior of this ear-corn feeder

A Hint for Draftsmen

TO remove ink from ruling pens and lettering pens dip them in a solution of ammonium hydroxide, or, as it is more popularly called, ammonia water. A strong solution will cause old ink as well as any kinds of waterproof ink to be easily wiped off with a cloth. I have used ammonia for a long time for this purpose and it does not seem to have any injurious effects on the pens. Ammonia also cleans ordinary steel pens equally well.—L. G. HASKELL.



An attractive grocery set which can be made by any housewife

Making a Cheap Grocery Set of Your Own

THE storing of staple groceries in the pantry is now giving way to placing them on open shelves in the kitchen. But an array of paper sacks and open boxes with their covers at all angles, is unsightly. Special sets of containers, made of glass, pottery or china, are rather expensive, but no housewife need be without a set. A dozen glass fruit-jars, quarts and pints, are very neat, require no labels and speak for themselves when the supply is low.

Ordinary tin coffee-cans make a fine set, when covered with varnished wall paper and labeled with ink. Pasteboard coffee-cartons, with hinged, tin pour-out spouts in the lids, are also available. Cocoa, mustard or baking-powder cans, when washed and painted, make excellent receptacles for spices. Even screw-top olive-bottles may be used to good advantage.—AVIS G. VESTAL.

Non-Irritating Skin Cleanser

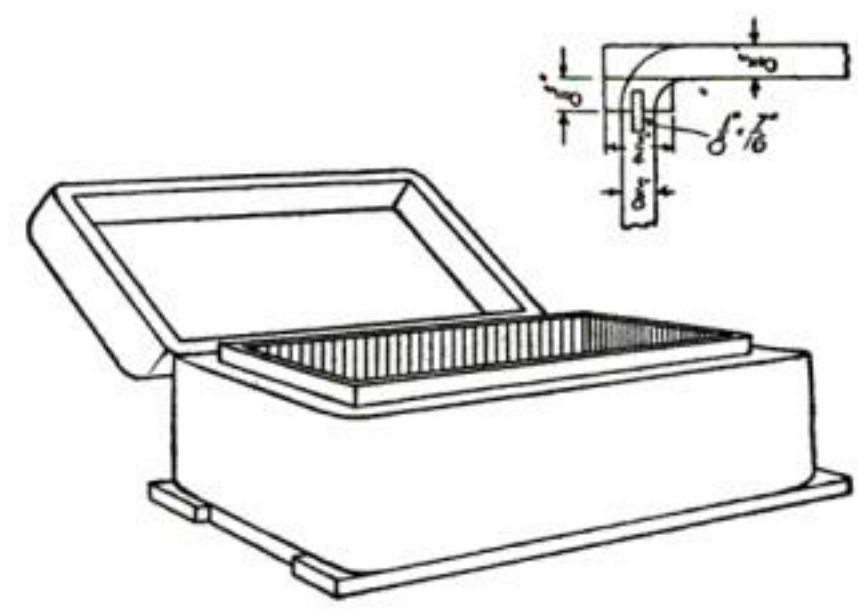
MECHANICS' hands, while not ordinarily tender, can in time be injured by the continued use of soaps and cleansers which contain caustics, sand or even pumice. An effective cleanser which can be substituted for these more dangerous ones consists of pure white soap dissolved in hot lemon juice. When cooled, the mixture will have the consistency of ordinary soft soap, and while it can be safely used on the most delicate skin, it will thoroughly remove all grease and dirt.

How to Make a Glove-Box

THIS glove-box is best made from some fancy wood such as walnut or mahogany. If these cannot be procured, a fine box may be made from red gum-wood, which has a large, close grain and takes a fine finish.

The sides are fastened together by means of small grooves and tongues. The small pieces ⅜″ x ¾″ x 3½″ should be fastened to the long side pieces by means of the rub joint. The glue should be hot. Rub the small block up and down on the side until it sticks firmly. Clamps are not necessary.

After the sides have been fastened together, the corners should be rounded off. Take the surplus off with the

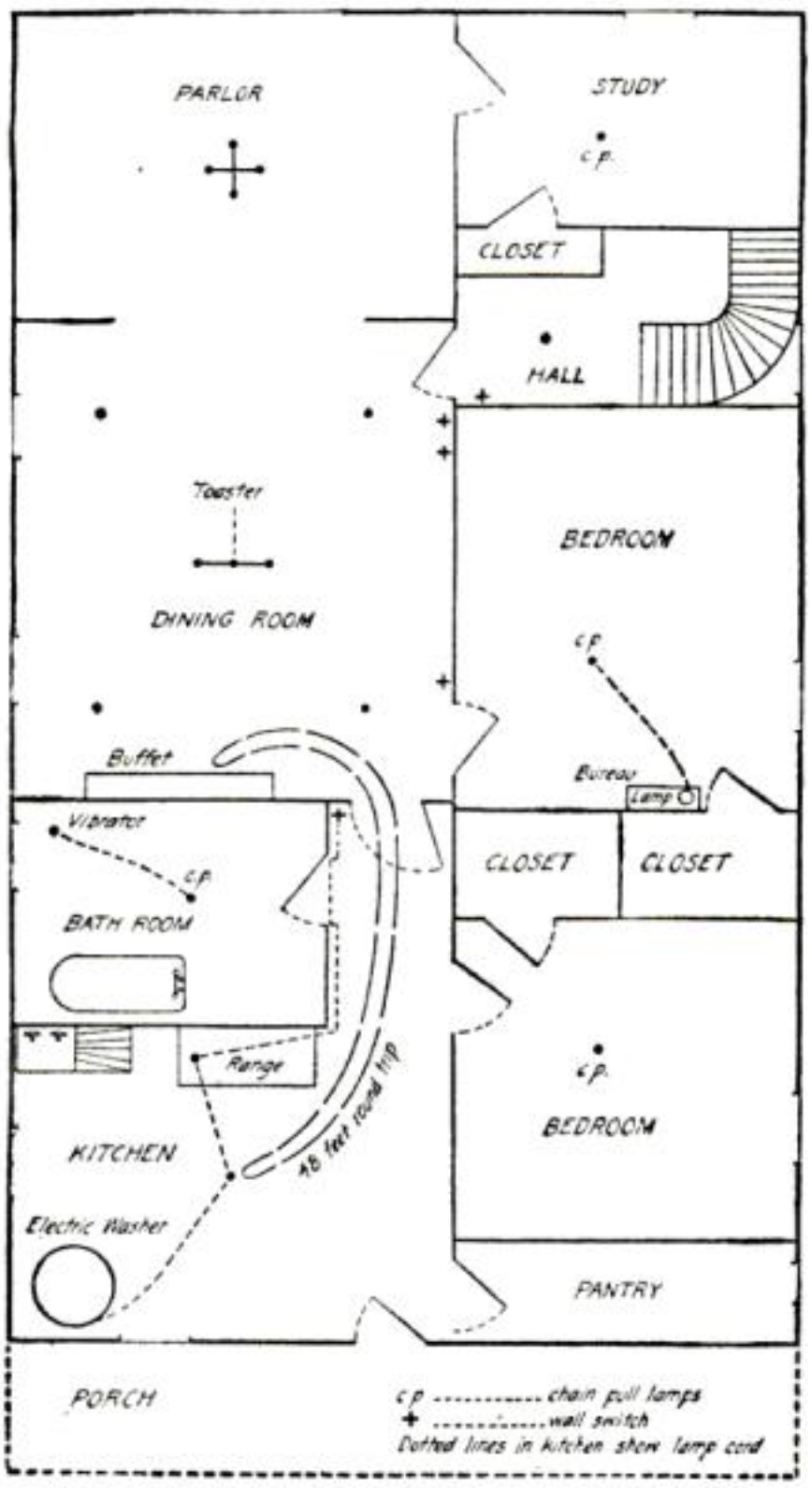


A glove-box made by hand from fine wood

chisel and gouge and finish with the half-round file. The inside of the box should then be sandpapered. Now fasten on the top and the bottom. Round off the top and sandpaper the entire box.

With a sharp-pointed marking-gage, mark a line around the box 3″ from the bottom. Saw off the cover, using great care to follow the line. True up the edges with a sharp plane and fasten on the cover with narrow hinges.

To finish the box, give it a coat of linseed oil. After rubbing this dry, apply a coat of white shellac. Smooth this off by rubbing with linseed oil and pumice stone. Then apply a second coat of shellac. Smooth this off with oil and rotten-stone, and apply the final coat of shellac, and polish.



Floor plan of the apartment showing the rearranged lighting system

Making Over the Lighting System

THOUSANDS of apartments in every city are wired and lighted in the most thoughtless manner possible. One husband, with a practical turn of mind, studied the situation, and in a few hours made a very convenient arrangement. The expense he had to bear himself, but all of the changes can be undone and the material removed to another apartment.

All of the lamps in the flat were sixteen candlepower carbon bulbs, giving relatively little light at a high cost for current consumption. Except in the dining room and parlor there was but a single lamp in a central ceiling fixture and set so high as to be difficult to reach. All of the lamps were of clear glass, hence glaring. The clothes closets had no lights and were so located that the single north windows could not possibly illuminate them. Moreover, the electric apparatus for which attachment was needed, could not be used without having each time to unscrew a solitary lamp and leave the room in blackness.

For the entire flat he purchased tungsten lamps of higher candlepower, thus securing more light for less current consumption. The reduction in monthly bills quickly compensated for the new lamps. The four small ceiling bulbs in the dining room were chosen of frosted glass; most of the other lamps have frosted tips. The four parlor bulbs he dipped in an amber solution to soften the light.

The central dining room fixture held three lamps. Two were sufficient for dining purposes and he removed the center one to permit morning attachment of the electric toaster.

A Safe Swing for the Baby

IN an Illinois town a clever mother has made for her "toddler" a swing from which he cannot easily fall. The wicker hood of an old baby carriage, shaped like half a muskmelon, is suspended by ropes from a low tree limb. If he tires of swinging he can fall asleep comfortably in the hollow of the basket; without danger.—AVIS G. VESTAL.

The baby swings in the hood of a discarded baby carriage

An Improved Match-Striker

TACK a piece of fly-screen over sandpaper of the same size. This will not wear out as readily as sandpaper alone.

Building a Bungalow—II.

By George M. Petersen

(Concluded from the April Number of the Popular Science Monthly)

HOW often we hear the expression "You should see my bungalow—the plan was original with me and we think it ideal in every way." Perhaps the plan was "original," so far as the speaker is concerned, but in reality the writer has never seen a really original bungalow that was a success. The fact of the matter is that every conceivable plan, that is worthy of the name, was discovered years ago and the so-called "new ideas" are only alterations or changes made in these old lay-outs. Of course there are new elevations that are original, and some of them are really pleasing, but on the whole they are only an assembled product combining the attractive features in several houses which the designer has seen.

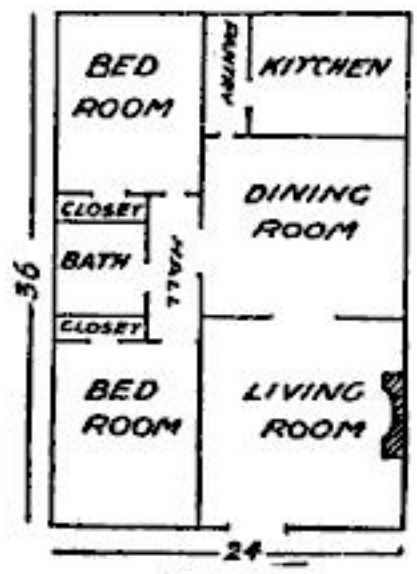


Fig. 1

The writer's experience in designing of residences has been wide. When he first started in he would feel highly elated over some new feature which he had conceived and installed in someone's plans, only to find out, sometimes months or years afterwards, that the idea had been used by someone else perhaps years before. It was rather discouraging, but was really unavoidable as the old saying that "there is nothing new under the sun" holds especially true in house design. There are numerous features in connection with modern appliances and conveniences that are either new or are worked up in such shape that they are really practical, but so far as the design itself is concerned it is the same old story under a new title. It therefore behooves the designer of houses not to say that the design was original with him as it is really an untruth.

So far as bungalow designs are concerned, the writer has never had the pleasure of seeing one yet that could not be directly traced back to one of the twenty used as the illustrations for this article, although it may be that there are one or two studies that have been omitted. It makes no difference how large or expensive the bungalow or house is, it must follow some general plan and these general plans are termed "plan studies" on account of the fact that the designer looks over his "studies," selects one that he thinks will be suitable to the arrangement he has in mind; and, with the study as a foundation, he designs the wonderful plan which people look over and remark how wonderful his plans are. His arrangement may be clever, his lighting arrangement may be nearly perfect, his heating plans may be exceptionally well arranged, his ventilating scheme may be well-nigh perfect and the whole may make a very pleasing, attractive and nearly perfect home, but when it is traced down it will be found that the living room can be found in so-and-so's house, the dining room in someone else's dwelling, the chamber arrangement may be brought down from the old Colonial days, while the fire-

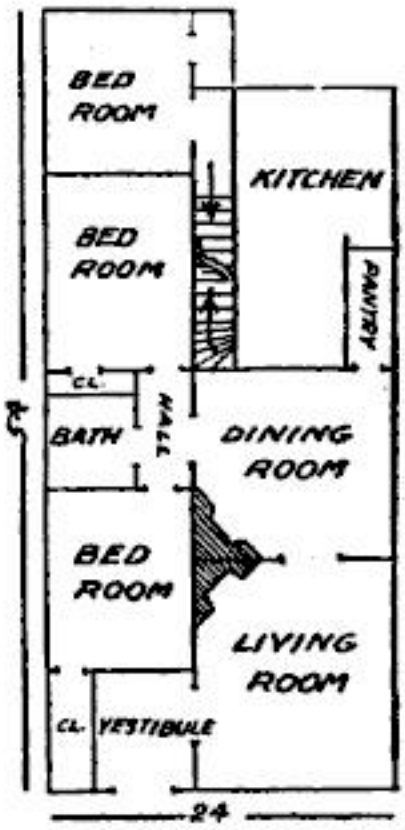


Fig. 3

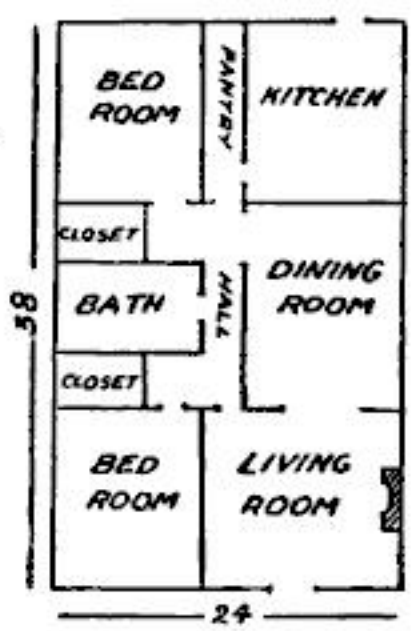


Fig. 2

places may be copied from the old masterpieces of the Old Country; the panel-work may be a relic of old England, while the exterior of the house may have been adapted from the Swiss chalet or some other type of architecture. To sum up the whole proposition, it may be said that the designer is a designer of details only and that only so far as their location and size are concerned.

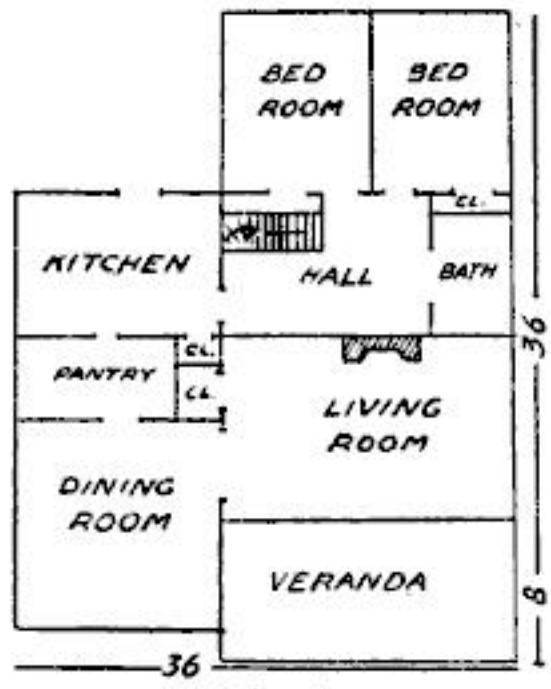


Fig. 4

With the thousand of different bungalow plans in use throughout the country, there is probably not one which cannot be traced, directly or indirectly, back to one of the general layouts or plan studies shown in the drawings submitted herewith. Of course the partitions may be shifted a few inches this way or that, the ceilings may be raised or lowered a few inches, the plan may be reversed so that the bedrooms come on the opposite side of the house, the fireplaces may be put into different locations in the rooms, the veranda may be shortened or lengthened, a pantry may be added or a pantry may be omitted, and other changes may be made that are too numerous to mention, but the plan is still the same as one of those shown.

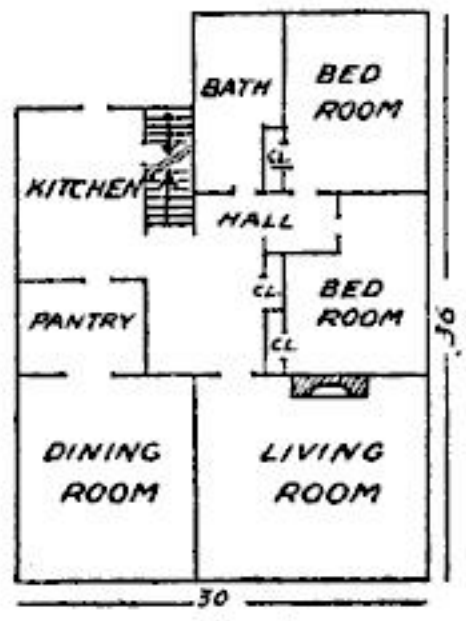


Fig. 5

In Figure 1 is shown a very common study from which some very plain but interesting layouts can be worked up with little difficulty, as the study is exceptionally valuable for the narrower type of city bungalows. This is one of the two-bedroom layouts which are so popular at the present time.

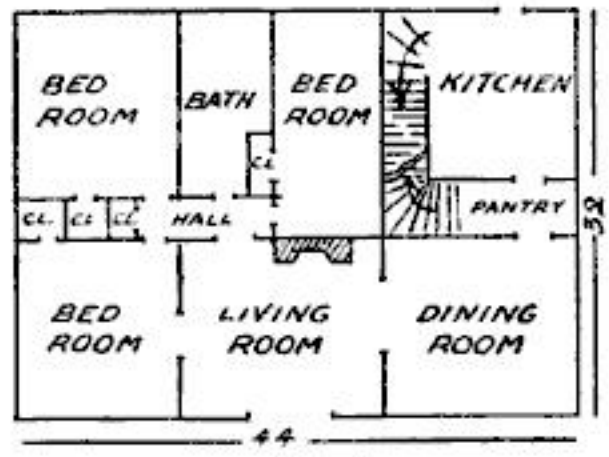


Fig. 6

Figure 2 shows a study which is very similar to that shown in Figure 1, the principal difference being in the location of the pantry and in the center hall arrangement which allows a person to get into any room in the house from any room in the house without passing through a third room. This study also places the kitchen in the corner of the rear of the house so that it has two sides completely exposed to assist in lighting and ventilating that important room. While this study closely resembles that shown in Figure 1 and may be termed a plan drawn from that study, it is nevertheless a study in itself, and a valuable one at that.

Figure 3 shows a study which treats with three bedrooms, a vestibuled front entrance, interior stairway to attic and cellar, and a fireplace chimney, which is so placed that a fireplace may be built in both the living room and dining room and still be connected to the same chimney, thereby saving a good many dollars for the owner. It will also be noticed that the amount of hall room, usually called "waste space," is exceptionally small. The third bedroom, the one off the kitchen, may be used as a maid's room, sewing room or just as a spare bedroom. By placing a door between this room and the one ahead of it the room may be brought into almost direct connection with the bathroom so that the trip through the kitchen can be avoided. This third room, when connected with a door, can be used, together with the room adjoining it, for the owner's suite—one room being used for a sleeping room and the other for a dressing room. When this arrangement is used, the third bedroom may be equipped with three windows on either side so that the effect is a great deal like that of a sleeping porch.

Figure 4 illustrates a type of house which is very desirable, but which is rather uncommon. The great advantage in this type of bungalow lies in the arrangement of the sleeping rooms. It

will be noted by the reader that the bathroom and the two sleeping rooms are at the rear of the house so that a person may use them with perfect freedom while visitors are being entertained in the living rooms. Again, a person may be in ill health or may be tired out so that he must retire before the regular time; in this case the arrangement of the sleeping rooms also is advantageous as by closing the door connecting the living room and rear hall the noise from the former is practically eliminated before reaching the bedrooms. The stairs to the attic and basement may also lead from this small hall, so that in the event of a billiard room being furnished in either place it will readily be reached without taking visitors through the kitchen. Take it all in all and the study shown in this figure is really worth actual study by anyone who is contemplating the erection of a bungalow for a home.

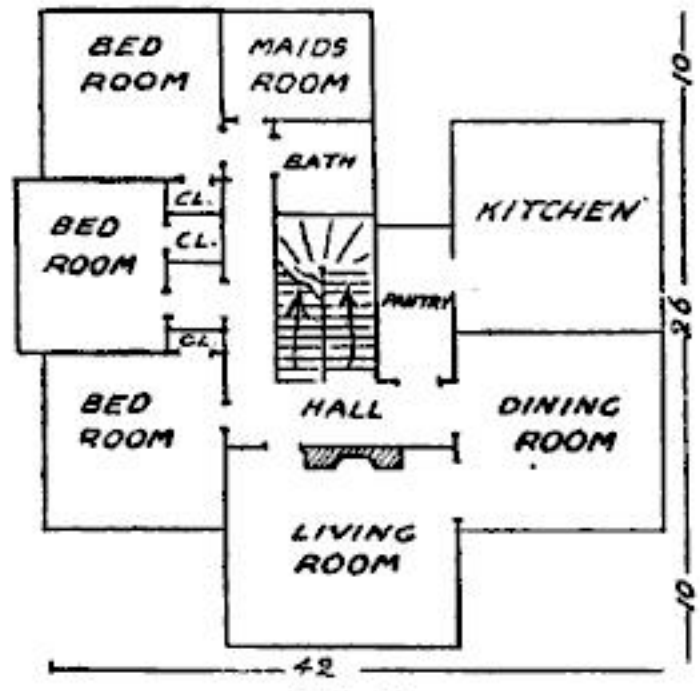


Fig. 7

Figure 5 is a study of a bungalow along the same general lines as those in Figure 4, but is a little cheaper house to build. The bathroom is, perhaps, in a little better location because of its being further removed from the living rooms and kitchen. There is also a disadvantage in the location of the bathroom due to the fact that the servant must come past all the sleeping rooms to reach it, whereas in Figure 4 the bath is directly opposite the kitchen door. This study also permits of a smaller house and for that reason is cheaper to build than is the one in Figure 4, as already stated.

Figure 6 is a study of a three bedroom, rear bedroom bungalow in which the least possible space has been consumed for the hall. The great disadvantage of this plan lies in the inability of a person getting from the kitchen to the bathroom without going through the living rooms. Aside from this one point and that of the location of the stairs, the study is a good one, since the three bedroom doors are all about an equal distance from the bathroom door.

Figure 7 gives us a study of a bungalow having four bedrooms, and this study strongly suggests two houses connected together on account of the sleeping portion of the house being built in a wing at the side of the living and service portions of the building. This arrangement is good for the size of the house, but there are better and more appropriate types of architecture for a four bedroom house than a bungalow, although this study is shown here as it is used to some extent.

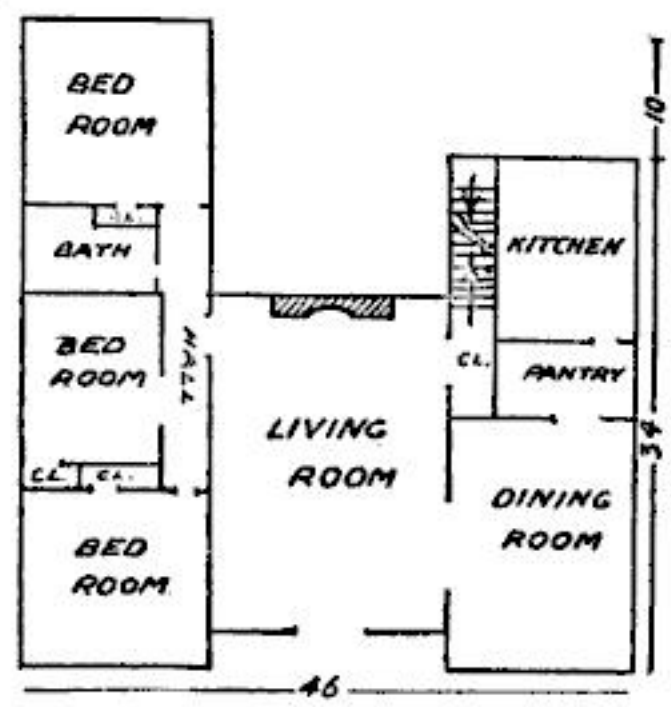


Fig. 8

Figure 8 is a very desirable type of bungalow, especially adapted to a warm climate where a conventional garden may be kept in the court. The ventilation of this type of house is also very good and the cost of erecting a house of this size and design are not as great as would be imagined. This type makes an ideal summer home, as the large living room is very comfortable on the cool summer evenings when the family desires to gather together indoors instead of on the broad, roomy veranda. Another feature of this study lies in the fact that the sleeping wing of the house may be extended back as far as is desired in order to obtain as many bedrooms as may be necessary. The dining room and kitchen may also be dropped back and a library or den placed in the location now occupied by the dining room. If it is desirable to leave the

dining room at the front of the house on account of the view or for any other reason, the den may be placed in the space occupied by the pantry and the pantry may be moved to the rear or some other location.

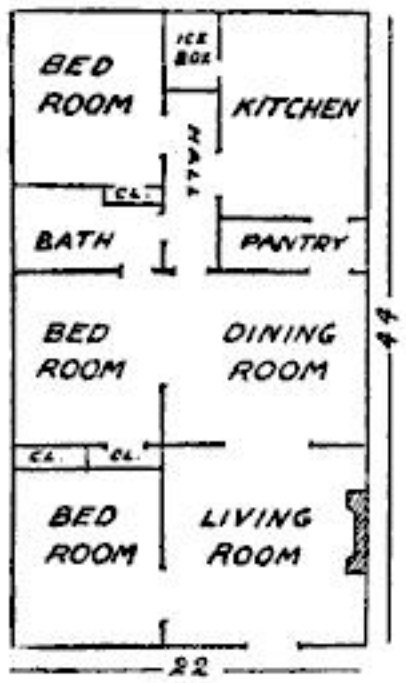


Fig. 9

In Figure 9 we have a study of a three bedroom bungalow which, while not the most artistic study shown in this article, is a very compact arrangement and a reasonable plan to build from. Every line is straight and economy is the principal feature. By making the house a trifle wider and running a hall down through the center so that all bedrooms would enter on to it and thereby be in direct communication with the bathroom, the arrangement would be greatly improved.

Figure 10 shows a very simple bungalow and is the cheapest study shown. It is the aim, from the viewpoint of economy, to keep any type of house as nearly square as possible and to meet this the study shown in this figure was worked up. The one great drawback to this particular study lies in its only having one bedroom, but that disadvantage can be readily overcome by working up a plan from the study and putting in as many bedrooms as may be desired, always remembering to keep the house as nearly square as possible, provided the lot on which it is to be erected is wide enough to allow for it.

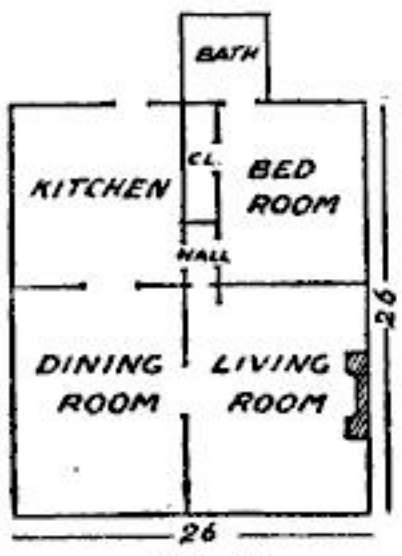


Fig. 10

In Figure 11 is shown a study which has unlimited possibilities at the hands of a clever designer. This study allows the kitchen to be well ventilated from three sides, which is a very good feature. The stairs going up to the billiard room in the attic are just off the living room and extremely handy when visitors are to be entertained in this manner. The cellar stairs go down from the kitchen and are right under the stairs going up into the attic, thereby saving floor space. The bedrooms and bathroom being at the rear of the house give the plan the desirable features mentioned under Figure 4.

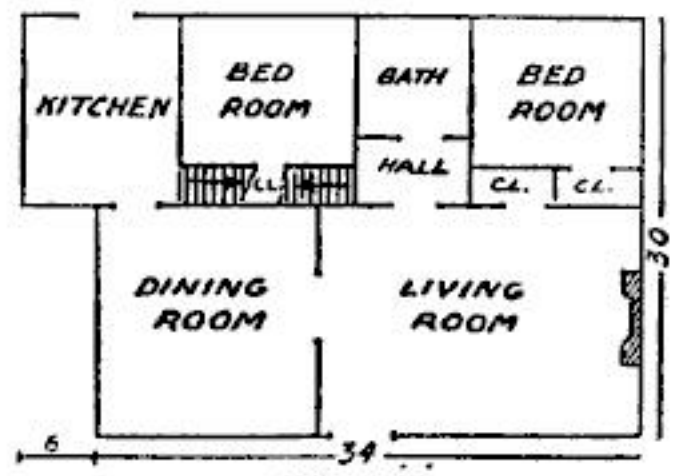


Fig. 11

Figure 12 shows a study which strongly resembles that shown in Figure 11, excepting that the bedroom is the room that is ventilated from three sides instead of the kitchen. The stairway to the second floor and the arrangement of the bathroom directly off the living room should also be noticed. The more the designer thinks over this study the more ideas will be obtained from it, since the study lends itself readily to a great many different arrangements which are pleasing and economical. The entrance into the living room from the side of the house instead of from the front in the conventional manner is greatly appreciated, especially in a summer home that faces a lake or other body of water. In a case of this kind it is always advisable and desirable to place the entrance on the side of the house opposite to that from which the prevailing wind is. This placing of the door will be greatly appreciated when the wind is blowing a heavy rainstorm ahead of it and driving the water through every possible opening, so that it is not only impossible to use the door but it is almost impossible

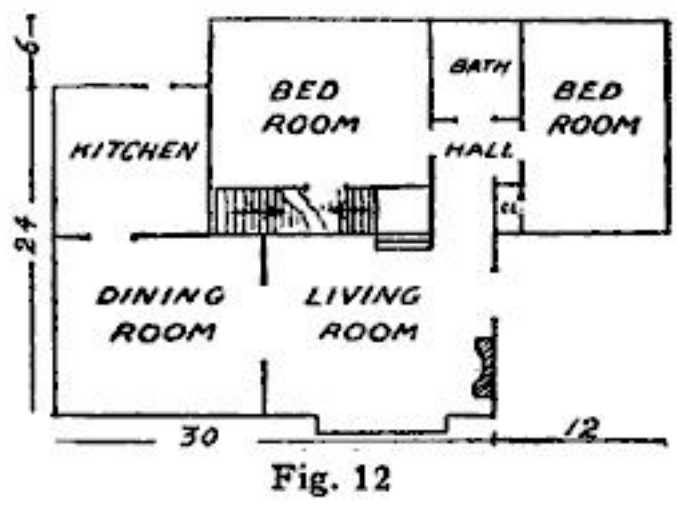


Fig. 12

to keep the rain from driving in around it.

Figure 13 shows another study which is especially desirable for summer use on account of the great wide living room which extends clear across the front of the building. In this study the living room and dining room are combined so that the cost is greatly reduced by omitting the one room and at the same time the most desirable view obtainable from the house may be secured while at meals, as well as when lounging in the living room after a tramp or a swim.

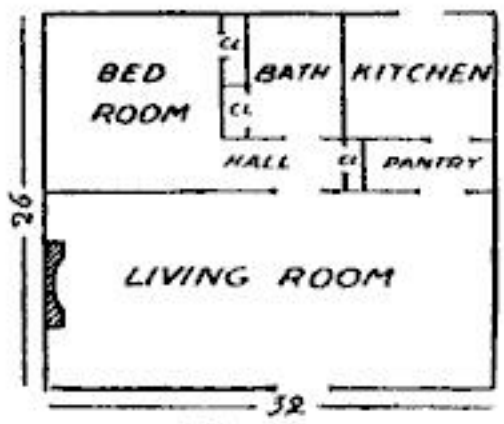


Fig. 13

Figure 14 has a strong tendency toward the general plan of Figure 13, but is considerably different when closely examined. In the first place the study shows two bedrooms and in the second, this study has a dining room which was omitted from the study in Figure 13. The resemblance lies in the large living room across the front and the arrangement of the kitchen, bathroom and rear bedroom. The dining room and the second bedroom are merely inserted between the living room and bedroom of Figure 13 and we thereby obtain another study with which to work.

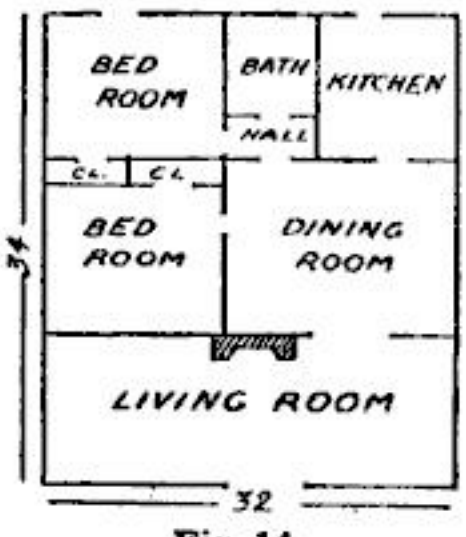


Fig. 14

Figure 15 shows a really clever study of a wide and shallow bungalow—one of those that make a very grand impression from the road but which have little depth when closely examined. As will be noticed by looking over the drawing, the three bedrooms and bath, instead of being placed at the rear of the house as in the studies shown in Figures 4, 5, 6, 11, 12 and 13, are placed at one end of the house. This arrangement allows the living rooms to be entirely separated from the sleeping rooms by closing the doors, as has been already explained, and also allows of perfect ventilation of the living room and dining room. The bathroom is in the handiest possible location for all of the rooms, and the three bedrooms are all of good size. The stairs may go up or down from the little hall between the dining room and kitchen and may go in the opposite direction from the other end. The most desirable arrangement, under the usual conditions, would be to have the cellar stairs lead down from the little hall, while the attic stairs lead up from the wall end of the partition and enter the dining room. A door may also lead up the stairs from the kitchen, if this is a desirable arrangement.

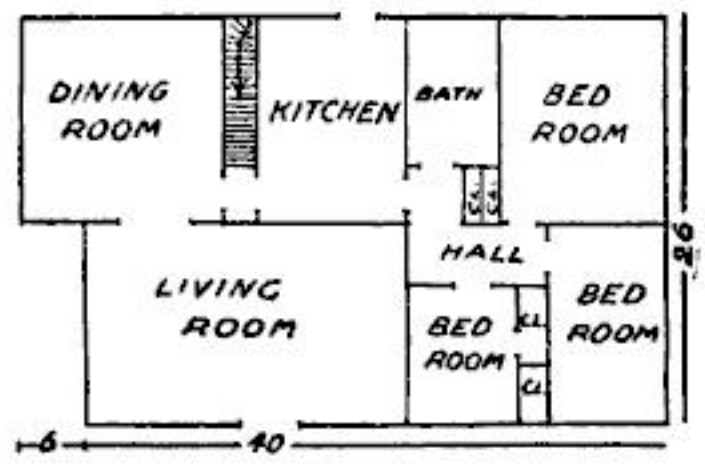


Fig. 15

The object of showing these arrangements or "studies" is to get the prospective builder into a habit of looking over plans and considering where they are weak and where strong and also to impress upon his mind that his opinion may be just as good as that of the average architect, so far as designing is concerned, at any rate.

The remarks about assembling various details into one plan are also given with a view to helping the prospective builder take notice of little arrangements, elevations, fixtures, color schemes and the other numerous details which go to make the completed building. By making notes on the things that "look good," at the time they are seen, a house which will contain just what you desire in almost every respect will result as you have seen these things actually finished and you do not have to guess what it will look like or take someone's word for it.

Keep the bungalow along conservative lines, and the ultimate effect will be refined rather than freakish.

The Popular Science Monthly for July

Are mine fields a real defense against submarines? Ships are being torpedoed every day in the mined English Channel and in harbors seemingly impregnable because of the extensive mine fields that guard the entrance. Could this happen in New York Harbor?

The Mine That Hears

One of the most prominent of our engineers has invented a system to destroy instantly any submarine which might attempt to penetrate into our harbors. He describes this wonderful invention in the July POPULAR SCIENCE MONTHLY.

How to Camp

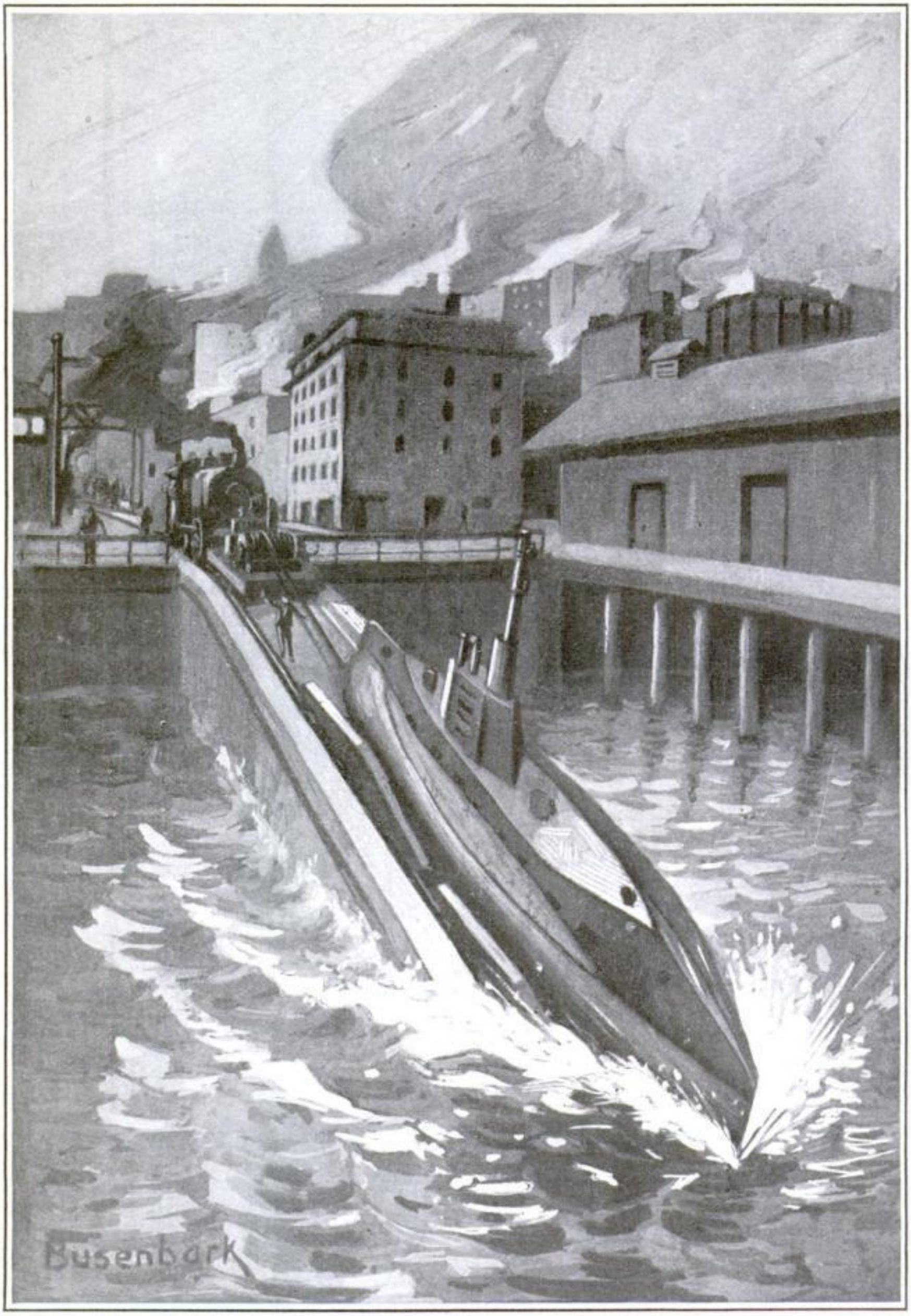
Are you going camping this summer? Next month will appear an article on this subject which will give new ideas to even the most seasoned camper.

What Sailors Don't Know About Sailing

Most yachtsmen think that they know how to sail a boat. They don't. Professor H. A. Everett, of Johns Hopkins University has analyzed the science of sailing a boat, and shows in the July issue just why most men handle their boats badly.

The Voice Typewriter; Talk and It Writes

Other features are: "Automobile Repair Kinks," "A Typewriter That Obeys the Human Voice," "A New Armor Protection for Ships," and—but why continue? There are three hundred more.



Simon Lake, the submarine inventor, suggests that we could mobilize two-hundred-ton submarines by rail. "The railway tracks would be continued down under the water as a submarine railway at such points as the government might desire. It would be necessary only to back the truck and submarine down into the water until the submarine floated"